PRINTED BY SOUTHLAND PRESS
1220 MAPLE AVENUE
LOS ANGELES, CALIFORNIA

American Cinematographer Hand Book

and

Reference Guide

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SIXTH EDITION

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Written and Compiled by

JACKSON J. ROSE

Member of

American Society of Cinematographers

1782 North Orange Drive

Hollywood -:- California

Printed in the United States of America

INTRODUCTION

A famous philosopher once said, "He who goes not forward, goes backward." That statement seems especially appropriate to those of us who, either as a profession or as an avocation, follow photography in any of its different forms, for photography is constantly advancing, and we must advance with it. New emulsions, new lenses, new cameras, projectors, lights and auxiliary equipment are being constantly evolved, and with them new uses of both still and motion photography. Regardless of how we use photography, or for what purpose, we cannot do it on the basis of yesterday's data on methods, materials or equipment.

For the same reason any handbook which, like this one, seeks to provide in convenient form the basic facts concerning photographic materials, methods and equipment, must progress, too. If it is to be at all worthwhile to its users, it must deal with the materials, equipment and problems of today, rather than those of yesterday.

It is for this reason that the present Sixth Edition of THE AMERICAN CINEMATOGRAPHER HANDBOOK AND REFERENCE GUIDE is now brought out. Like each of the five previous editions which went before, it is larger and more comprehensive than its predecessors, and, I hope, increasingly useful to its readers. The sections devoted to such basic data as film of all kinds (35mm, 16mm and 8mm), film, filter factors, cameras, lamps, exposure-meters, and the like, have been brought fully up to date. In addition, in response to popular demand, new sections covering such subjects as 16mm silent and sound projectors, 8mm silent projectors, still minislide projectors, new copying and enlarging charts for miniature cameras, data concerning Photoflash and Photoflood lamps, with exposure charts, and the leading color processes have been added. It is the author's sincere hope that these revisions and additions will make this handbook even more helpful to its users than have been the other five editions.

In closing, I would like to express my heartfelt appreciation to all the many individuals and firms who have been so generous in providing and verifying the information regarding their products, criticising the arrangement of the material, and suggesting ways in which the book and its contents might be improved. In this, too, I wish surely to include the many users of the previous editions who have taken the trouble to suggest to me things which they felt should be included in the book to make it more practically helpful to them. In so far as possible, I have tried to follow out these suggestions; and in any event I appreciate them as evidence that this little book, which began some ten years ago as a private compilation of photographic facts for my own use, is now for the sixth time "all dressed up" and apparently with many very definite places to go.

JACKSON J. ROSE, A.S.C.,
Hollywood, California.

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MOTION PICTURE CAMERAS
35 mm.

CAMERA	SHUTTER	LENS MOUNTS	TYPE OF MOVEMENT	TYPE OF FOCUS
BELL & HOWELL CAMERA Standard Model	170 degrees, hand or automatic dissolves, visible dial shows shutter opening. Shutter may be locked at any shutter opening.	4 Lens turret, micrometer focus mounts, interchangeable to various size lenses, properly mounted. Index pin turret lock.	Intermittent movement, fixed pilot pin registration. Positive action and rigid position of film during exposure. Can be adapted for high speed operation, pilot pin and high speed check pawl movements may be used interchangeably. The pilot pin film moving mechanism is also used in rear projection equipment.	Three methods. Thru focussing aperture with magnifier. Thru camera door on film or ground glass with prism. With calibrated lens scale.
BELL & HOWELL EYEMO CAMERA Model Q	160 degrees	Offset three-arm turret with micrometer focusing mounts, permits the use of short or long focus lenses. Mounts held by two locking clips, permitting the rapid change of lenses.	Film is fed by upper sprocket behind film gate, shuttle, teeth carry film past aperture to lower sprocket. Model Q has speed of 8, 12, 16, 24, 32 and 48 Can be cranked backward for double ex-	Accurate visual focusing through prismatic focusing magnifier. Also lens calibrations. posure, as far as the spring motor is unwound.

MOTION PICTURE CAMERAS
35 mm.

	MAGAZINES AND CAPACITY	TYPE OF FINDER	TYPE OF DRIVE	LENSES	OTHER FEATURES Normal Speed
STANDARD MODEL	Double compartment type, interlocking light trap controlled by camera door, belt driven take-up, 200 ft., 400 ft. and 1000 ft. capacity.	Large universal finder with adjustable extension and matched mattes for various size lenses.	Hand crank or motor direct to main shaft. Visible adjustment of motor speeds from 2 pictures per second to 32 pictures per second up to 200 frames per second with high speed motor.	Cooke speed panchro F.2 all sizes available. These lenses are supplied Filmocoted for increased illumination and elimination of glare.	Motor may be run forward or reverse with pilot pin mechanism. Check pawl ultra-speed mechanism for hi-speed work up to 200 pictures per second with perfect registration, for operation in the forward direction only. 52 piece aperture vignettes available. Many accessories for all production purposes.
MODEL Q	Daylight loading 100 foot spools, or external magazines of 200 or 400 foot capacity. Magazine take-up is by means of a spring belt.	Revolving Turret type. Positive view finder.	Governor controlled spring motor, exposing 55 feet of film per winding, 12-volt, 24-volt or 110-volt Universal type motor.	EYMAX 50 m.m. F. 2.8 standard equipment. Cooke Speed Panchro F.2 lenses also available. All are Filmocoted.	Portable type camera. Sound aperture, flat base tripod head, focusing alignment gauge, exposure indicator. Marginal tension at the aperture, aperture plate of stainless steel. Adapted for external magazines and electric motor drive.

MOTION PICTURE CAMERAS
35 mm.

CAMERA	SHUTTER	LENS MOUNTS	TYPE OF MOVEMENT	TYPE OF FOCUS
BELL & HOWELL EYEMO CAMERA Model K	160 degrees.	Single lens F.2.8 with 50mm. Eymax lens as standard equipment.	Film is fed by upper sprocket behind film gate. Shuttle teeth carry film to aperture plate, thence to lower sprocket. Variable speeds of 8, 12, 16, 24 32 and 48 frames per second May be cranked backward for double exposure, as far as the spring is unwound.	By lens calibrations only.
BELL & HOWELL EYEMO CAMERA Model M	160 degrees.	Three lens turret, micrometer focusing mount, turret revolves in either direction, opening of two locking clips permits lenses to be quickly changed EYEMO Type C mount.	Same as Model K. has variable speeds of 8, 12, 16, 24, 32 and 48 frames per second.	By lens calibration only.

MOTION PICTURE CAMERAS

35 mm.

	MAGAZINES AND CAPACITY	TYPE OF FINDER	TYPE OF DRIVE	LENSES	OTHER FEATURES
MODEL K	100 foot daylight loading spools.	Positive. Single objective view finder.	Spring driven governor controlled mechanism exposing 55 feet of film per winding.	Eyemax F.2.8 50mm lens is standard equipmenr. Also Cooke Speed Panchro F.2 lenses. All are Filmocoted.	Portable type camera. Exposure indicator, auxiliary finder unit for long focus lenses, sound aperture, adjustable diaphragm and focusing scale, footage counter, side tension on film at the aperture, stainless steel aperture plate.
MODEL M	100 foot daylight loading spools.	Revolving Turret type. Positive view finder.	Spring driven governor controlled mechanism, exposing 55 feet of film per winding.	Eymax F. 2.8 50mm. lens is standard equipment. Also Cooke Speed Panchro F.2 lenses. All are Filmocoted.	Portable type camera. Flat base for Eyemo tripod head, exposure indicator, sound aperture adjustable diaphragm and focusing scale, footage counter, marginal tension employed, stainless steel aperture plates.

MOTION PICTURE CAMERAS

35 mm.

CAMERA	SHUTTER	LENS MOUNTS	TYPE OF MOVEMENT	TYPE OF FOCUS
ACME Animation and Special Effects CAMERA	170 degrees, built-in filters for 3-color process, balanced for equalized exposure.	Single lens mount, non-rotating.	Pilot pin registration, special pressure plate. Will take one or two films without adjustment.	Automatic follow focus with Selsyn Motor.
ACME CAMERA Silent Studio Model	170 degrees, adjustable manually operated for dissolves.	Single lens, Bayonet lock type. Interchangeable mount.	Registration pin. Fixed pilot pin with positive registration.	Focusing microscope with adjustable eyepiece. Also lens Scale.
REEVES MOTION PICTURE REFLEX CAMERA	Variable control 170 degree opening. Indicator on back of camera for hand dissolves. Can be controlled while camera is in operation	Three lens turret Calibrated focusing mounts. One hand control. Special lens shade.	Pilot pin registration. Can be operated with or without pilot pin to take care of film shrinkage. Standard roller pressure plate.	Focusing microscope adjustable magnifier. Picture right side up and correct as to right and left. Also lens calibrations.

MOTION PICTURE CAMERAS

35 mm.

	MAGAZINES AND CAPACITY	TYPE OF FINDER	TYPE OF DRIVE	LENSES	OTHER FEATURES
ACME ANIMATION	Uses standard double compartment Mitchell 1000 ft., also Bipack Automatic take-up forward or reverse.	Reflex through photographic lens. No parallex. Every frame can be viewed without fogging film. Registration pins on finder to superimpose positive film.	Special Acme motor for stop motion, 1 to 1 or 3 to 1 (successive frame) 3-color process, 6 speeds. Exposure 1/4, 1/3, 1/2, 1, 2, 3, and 5 seconds. Motor can be synchronized to background projector for glass shots.	Special 50mm. lens color corrected.	Perfect registration. Can be be used for color optical printing. Forward or reverse. Can be used to photograph Technicolor in stop motion.
ACME STUDIO MODEL	Uses standard double compartment Mitchell 1,000 ft.	Erect image reflex finder through photographic lens, making it possible to see the subject while the camera is running. There is no parallax.	Inter-lock or wild motor of any standard voltage. A.C. or D.C. can be had.	Any standard make 40, 50, 75, 100mm.	Camera is silent and can be used without blimp. Has perfect registration. No obstruction or pelica mirror between finder and lens so that camera can be used for color photography as well as black and white.
REEVES REFLEX	400 ft. Reeves special. Revolving discs in take-up slide prevent buckling. Can also take Mitchell magazines.	Reflecting finder through photo lens while camera is in operation. Also direct vision auxiliary view finder.	Lightweight motor 16 to 48 frames. 12-24 or 110 volts. Quick detachable. A.C. or D.C.	Bausch & Lomb Baltar F. 2.3 or all sizes of any standard make.	Picture is viewed through shooting lens during operation. Very light weight. Automatic buckleproof device.

MOTION PICTURE CAMERAS
35 mm.

CAMERA	SHUTTER	LENS MOUNTS	TYPE OF MOVEMENT	TYPE OF FOCUS
AKELEY CAMERA Sound Model Single or Double System	Standard Audio camera has a shutter of 225 degrees, but a 6 blade shutter of 280 degrees is available. Manual or mechanical dissolves. Dissolve meter shows when in automatic operation. 4, 6 or 8 feet. Dial showing opening.	Three types of lens plates furnished. Single matched, pair as in standard camera, turret plate carrying two sets matched lenses, and revolving turret with three lenses, either plate may be replaced with other groups of lenses.	The film movement has positive registration pins, roller type stainless steel gate and removable as a unit with focussing plate for examination or oiling, adapted to Bi-pack, pressure rollers insure contact.	High power focusing microscope with adjustable magnification is used on focusing turret directly through the taking aperture. Also by lens calibrations.
AKELEY CAMERA Standard Model	Two types of shutters, 230 degrees focal plane type non-adjustable and 180 degrees focal plane type adjustable, manual or mechanical dissolves.	Special dual lens plate carrying picture and finder lens which are geared together and rack forward and backward simultaneously. Interchangeable to all size lenses mounted on dual plate.	Self adjusting needle pin movement operated by cam. Feed sprocket in magazine engages with driving mechanism of shutter and movement. Pressure plate on movable gate locks into position.	Direct on ground glass through combination focus and finder tube with geared twin lenses. Tube has three time magnifier and is adjustable to many positions. Also by lens calibrations.
20th CENTURY FOX CAMERA	200 degrees, adjustable, visible window showing shutter opening.	Revolving turret, 4 lens micrometer focus mounts, non-rotating rising and falling adjustment on turret plate, type.	Oscillating pin, pilot pin registration stationary during exposure.	Camera angle shift over erect image magnifying telescope direct on ground glass.

MOTION PICTURE CAMERAS

35 mm.

	MAGAZINES AND CAPACITY	TYPE OF FINDER	TYPE OF DRIVE	LENSES	OTHER FEATURES
AKELEY SOUND	Double compartment type, ball bearing and spring device in hubs prevent thumping, collapsible spools, endless take-up belt, 400 ft, 1000 ft. and 2000 ft.	Same tube as used for focus. 8 power magnifier.	D. C. soundproofed motor by friction connection to drive shaft of camera. Tachometer with speed indicator dial.	With focusing turret, Bausch & Lomb Raytor series Carl Zeiss Biotar and Tessar series and Dallmeyer lenses.	Safety sprocket with automatic slippage in case film jams. Filtered sound sprocket fly-wheel, ball bearing. Dual or single sound system, safety motor reverse switch.
AKELEY	Duplex type of sheet aluminum, placed inside of camera. Exposed and un-exposed film in same retort. The magazine contains feed sprocket and hollow rollers which also act as light trap. 200 ft. capacity.	Floating type showing duplicate image right side up, thru geared twin lenses, has three time magnifier with rubber covered adjustable eye piece.	Hand crank, forward or reverse, may be run up to four times normal.	Twin matched lenses from 40mm to 17 in. on mounted dual plate, picture and finder lens. Goerz, Dallmeyer, Bausch & Lomb and Carl Zeiss.	Has accurate follow focus, ball and socket quick leveling tripod head. Long adjustable handle for pan or tilt operation. Lens shade, camera can point straight up or straight down, camera has no sprockets —has film punch. Field tripod with special leg locking device.
20TH CENTURY	Double compartment type, controlled light trap, rubber covered, 1000 ft. capacity.	Adjustable finder with parallax correction and variable mattes for all lenses, large erect upright image.	External synchronous or interlock type may be used and driven at shutter speed.	Any standard make or size.	Camera can be threaded in shooting or looking position. Follow focus attachment in front of camera, lenses do not revolve when being focussed.

MOTION PICTURE CAMERAS

35 mm.

CAMERA	SHUTTER	LENS MOUNTS	TYPE OF MOVEMENT	TYPE OF FOCUS
MITCHELL CAMERA Standard Model	Planetary Gear Type. 170 degrees, Hand or Automatic dissolves in 2, 4 or 8 ft.	4 Lens turret, micrometer focus mounts, adjustable rising and falling turret plate with index pin lock.	Positive acting pull down pins, pilot pin registration, operates forward or backward, interchangeable hi-speed movement, operating from one picture per second to 128 pictures per second.	Camera shift-over, erect image focusing telescope with 5 to 10 time magnification, 2 viewing filters mounted in focus tube. Also lens calibrations.
MITCHELL CAMERA Sound Model Also Known As N. C. Model	Special registration plate, 175 degrees, manually operated dissolve with visible graduated segment showing various shutter openings, control lock for any opening.	Same as in standard camera, interchangeable mounts for various size lenses.	New eccentric movement with positive registering pins, pull down arm engages four perforations simultaneously, forward or backward action.	Same as in standard camera, image seen on ground glass correct as to right and left. Large eye piece with adjustments. 5 and 10 time magnification.

MOTION PICTURE CAMERAS

35 mm.

	MAGAZINES AND CAPACITY	TYPE OF FINDER	TYPE OF DRIVE	LENSES	OTHER FEATURES
MITCHELL STANDARD	Double compartment type, light trap controlled by camera door, automatic belt tightener, 400 ft. or 1000 ft. capacity.	Large erect image prism view finder with matetes for various size lenses.	External motor 110 volts A.C. or D.C. adjustable speed control from 4 to 24 pictures per second.	Astro Pan Tachar, F. 1.8 all sizes. Astro Pan Tachar. F. 2.3 all sizes. Bausch & Lomb Baltar F. 2.3 all sizes. Carl Zeiss Series F. 2.7 all sizes.	Focusing without disturbing lens position. Built in disc for holding 8 separate filters. Adjustable built-in four way matts and floating iris. Hi-speed movement with positive registration pins for ultra-speed work. Hi-speed gear box with adjustments for eleven different speeds. Many accessories for all production purposes.
MITCHELL SOUND MODEL	Double compartment type, frictionless light trap, velvet covered rollers, anti-buckler, rubber insulated, hi-speed take-up. 1000 ft. capacity. Also bi-pack magazines.	Large erect image prism view finder, adjustable built-in mattes for various lenses, parallax adjustment.	New type motor direct to movement which drives shutter shaft, magazine take-up and counter, automatic motor kick-out in case of buckle, special soundproof housing.	Astro Pan Tachar, F. 1.8 all sizes. Astro Pan Tachar, F. 2.3 all sizes. Bausch & Lomb Baltar F. 2.3 all sizes. Carl Zeiss Series F. 2.7 all sizes.	Can be used without special covering for sound work, miniature shutter on rear of camera showing shutter opening, insulated plate to magazines for noise reduction, large handle for quick camera shift-over, all other features of standard camera.

MOTION PICTURE CAMERAS

35 mm.

CAMERA	SHUTTER	LENS MOUNTS	TYPE OF MOVEMENT	TYPE OF FOCUS
MITCHELL CAMERA New Studio Model Also known as B-N-C Model	Special registration plate, 175 degrees, 4 foot automatic fade, visible graduated segment showing various shutter openings, control lock for any opening.	Single lens, interchangeable mount, bayonet lock type, accommodating from 24 mm. and up to any size of all standard makes.	New eccentric movement with positive registering pin, pull down arm engages four perforations simultaneously, forward or backward action.	Same as in standard camera, image seen on ground glass correct as to right and left. Large eye piece with adjustments. 5 and 10 time magnification.
MITCHELL CAMERA Single System Sound	Special registration plate, 175 degrees, manually operated dissolve with visible graduated segment. showing various shutter openings, control lock for any opening.	4 lens turret Micrometer focus mounts 24mm. to any size.	New eccentric movement with positive registering pins, pull down arm engages four perforations simultaneously forward or backward.	Camera shift-over erect image focusing telescope with 5 to 10 time magnification. Also lens calibrations.
DE VRY CAMERA Standard Model A	130 degrees, fixed position, no dissolve	Single lens, De Vry bayonet mount, interchangeable to other lenses if in similar mount.	Single two tooth claw movement with removable film gate.	Through prism direct on film, also by lens calibrations.

MOTION PICTURE CAMERAS

35 mm.

	MAGAZINES AND CAPACITY	TYPE OF FINDER	TYPE OF DRIVE	LENSES	OTHER FEATURES
MITCHELL STUDIO MODEL					
MITCHELL SINGLE SYSTEM SOUND	Double compartment type, frictionless light trap, velvet covered rollers, anti-buckler, rubber insulation, hi-speed take-up, 1000 ft. capacity, magazine enclosed in special soundproofhousing. Also Bi-pack maggazines.	Large erect image prism view finder, adjustable built-in mattes for various lenses, parallax adjustment and focusing of finder, same operation as focusing picture lens.	Same drive as used in sound model with special noiseless and soundproof housing.	Astro Pan Tachar, F. 1.8 all sizes. Astro Pan Tachar, F. 2.3 all sizes. Bausch & Lomb Baltar. F. 2.3 all sizes. Carl Zeiss Series F. 2.7 all sizes.	All built in features controlled from outside of camera, control for synchronous shutter with background projector, 2 footage counters.
	Double compartment type 400 ft. to 1000 ft. capacity wind guard keeps belt secure in aeroplane work.	Large erect image prism view finder adjustable mattes for various lenses, parallax adjustment quick release lock.	24 volt or 12 volt motor mounted on side of camera. Also 110 volt variable speed Mitchell Motor.	Astro Pan Tachar F. 1.8 all sizes. Astro Pan Tachar F.2.3 all sizes. Bausch & Lomb Baltar F.2.3 and Carl Zeiss series F.2.7 all sizes.	Tachometer on rear of camera. R.C.A. or Western Electric sound systems can be used. Also features of other Mitchell Cameras.
DEVRY	Daylight loading inside magazines, single type, round, 100 ft. capacity.	Eye level direct vision, also reflecting right angle view finder.	Double spring drive, 55 ft. per winding, also may be hand cranked at any normal speed.	De Vry anastigmat, 35mm F. 3.5, 50mm F. 1.5, 50mm F. 3.5, 75mm F. 3.5, 100mm F. 4.5, 150mm F. 4.5.	Strong release button, anti-buckling device, footage meter, ball bearing take-up, removable film gate and spool gauge,

MOTION PICTURE CAMERAS
35 mm.

CAMERA	SHUTTER	LENS MOUNTS	TYPE OF MOVEMENT	TYPE OF FOCUS
UNIVERSAL CAMERA Turret Model	180 degrees, automatic and adjustable dissolves.	Revolving turret with three lenses, screw type mounts interchangeable to other sizes.	Double claw action, pull down movement, forward and reverse, spring pressure plate holds film during exposure.	Focusing direct on film through focus tube also by lens calibrations.
UNIVERSAL CAMERA Standard Model	180 degrees, non-adjustable.	Single lens in screw mount interchangeable for many sizes.	Claw action, forward and reverse, pressure plate holds film in position during exposure.	Focusing direct on film through focus tube also by lens calibrations.
WALL CAMERA Standard Sound Model	170 degrees, adjustable, complete fade-out.	4 lens revolving turret, micrometer focus mounts with bayonet lock, rising and falling front with micrometer adjustment, turret lever lock.	Removable silent intermittent movement having adjustable stroke, combination feed and take-up sprocket. Special camera has hi-speed D type intermittent. Entire movement enclosed in dust-proof case with unlocking device for quick removal.	Built-in erect image focusing telescope with five time magnifier, focusing on ground glass camera shift over from taking position with large shift lever, built-in viewing filters, focus also by lens calibrations.

MOTION PICTURE CAMERAS

35 mm.

	MAGAZINES AND CAPACITY	TYPE OF FINDER	TYPE OF DRIVE	LENSES	OTHER FEATURES
UNIVERSAL	Inside, aluminum box type single compartment 200 feet capacity.	Direct vision view finder with telescope tube.	Hand crank for forward or reverse actions.	Dallmeyer Ultrastigmat F. 1.9.	Compact metal case, direct gear take-up, individual frame control. Universal tripod with standard pan and tilt head.
	Inside, aluminum box type single compartment 200 ft.	Telescopic tube direct vision view finder.	Hand crank for forward or reverse action.	Bausch & Lomb Tessar F. 3.5.	Individual frame control, direct gear take-up, aluminum case, 400 foot capacity if desired. Universal tripod with standard pan and tilt head.
WALL	Outside, double compartment type lined with black corduroy, light trap controlled by camera door lock, light trap is removable, automatic take-up tension, collapsible spool, fibre belt, ball bearing frictionless light trap, 400 or 1000 ft.	Combination finder and focusing tube, after focusing, camera is shifted over and finder is in position. Special camera has same view finder.	Direct drive soundproof motor, forward or reverse action, synchronous or interlocking, 12 or 110 volt furnished.	Bausch & Lomb Baltar 35, 50, 75, and 100 mm. F.2.3 and 152 mm. F.2.7 Lenses. Do not revolve when focusing and completely iris out.	Matte and filter holder slot in camera, Tachometer with adjustable speed control, built-in feeder counter, interchangeable sound unit, film punch, collapsible sun shade and filter holder interior of camera is covered with black velvet.

ANSCO MOTION PICTURE FILMS

35mm. NEGATIVE AND POSITIVE

NAME	TYPE	USE	CHARACTERISTICS	SPEED: WESTON Day	SPEED: WESTON Tung.	SPEED: G. E. Day	SPEED: G. E. Tung.
ULTRA-SPEED	Neg.	Studio interiors—News reel Slow motion, adverse light conditions	Extreme speed, normal grain—Full color sensitivity	100	64	150	100
SUPREME	Neg.	General production work. All class of photography	High speed—Fine grain—Full color sensitivity	50	32	80	48
COLORPAK CAMERA FILM, TYPES 735 (NITRATE BASE) AND 835 (SAFETY BASE)	Rev.	Original taking film for general color photography when release prints are needed	Balanced for exposure by daylight or carbon arcs with Y1 filters. Suitable as an original for printing but not for projection	10	......	16	......
COLORPAK RELEASE PRINT FILM, TYPES 732 (NITRATE BASE) AND 832 (SAFETY BASE)	Rev.	Color release prints from Colorpak Types 735 and 835	Integral tripack color printing medium yields a positive from a positive	......	......	......	......
COLORPAK DUPLICATING FILM, TYPES 132 (NITRATE BASE) AND 232 (SAFETY BASE)	Reversal	Master dupes from Colorpak Types 735 and 835	Integral tripack color printing medium yields a positive from a positive	......	......	......	......

DUPONT MOTION PICTURE FILMS

35mm NEGATIVE AND DUPLICATING STOCK

NAME	Type	USE	CHARACTERISTICS	DEVELOPING DATA			Code	SPEED			
								WESTON		G. E.	
				Min.	Temp.	Form		Day	Tung.	Day	Tung.
SUPERIOR 1	104	General exterior and background projection	Extreme fine grain, wide latitude, normal contrast	7	68°	ND1	B	8	6	12	10
SUPERIOR 2	126	Exterior and interior all-purpose stock	Fine grain, high speed, wide latitude, excellent flesh-tone rendition	8	68°	ND1	2	64	40	100	64
SUPERIOR 3	127	Exterior and interior, poor light conditions	Extreme speed, normal grain, full color sensitivity	11	68°	ND1	3	100	64	150	100
INFRA D	105	Aerial work, haze cutting, night effects in sunlight	Green foliage rendered in natural tones, rather than as white	7	68°	ND1	D				
PANCHROMATIC DUPLICATING NEGATIVE	108	For making dupes from lavender	Fine grain, non-halation negative base, high resolution emulsion	6	68°	ND1	P				
LAVENDER POSITIVE	217	Master prints for dupe negatives	Normal positive speed, blue sensitive only.	3½	68°	PD3					
FINE GRAIN POSITIVE	228	Master positives for release prints	Fine grain, uniform density, scratch resistance, durability	3	68°	PD3	—				

DUPONT MOTION PICTURE FILMS

SOUND RECORDING, RELEASE POSITIVE & SPECIAL PURPOSE

NAME	TYPE	USE	REMARKS
SOUND RECORDING	201	For variable density work	Positive type emulsion, approximately double the speed of regular positive; free from fog at high gammas.
FINE GRAIN SOUND RECORDING	226	For variable density and variable area recording.	In variable density, exceptionally high signal to noise ratio and freedom from objectionable 96-cycle effects. In variable area white light recording combines inherent low fog and high latent image stability.
FINE GRAIN SOUND POSITIVE	232	For variable density sound negatives.	Medium contrast. Fine grain positive for processing of white light sound prints from high gamma V.D. sound negatives. With normal development and white light printing its contrast is favorable to ultra-violet light printing.
FINE GRAIN SOUND POSITIVE	236	For both "low" and "high" camera recording.	Extremely sensitive fine grain recording film, for both "low" and "high" camera recording. Excellent sound reproduction from white light printing. Good distortion and print latitude characteristics.
RELEASE POSITIVE	213*	Wherever insufficient light is available.	For use wherever insufficient light is available for the printing of fine grain positive. Standard speed—Weston, Tungsten 2.
FINE GRAIN RELEASE POSITIVE	225*	For general release work.	For general release work and dubbing prints which require the optimum of picture and sound quality. Image color—blue-black. Inherent noise level—exceptionally low. Emulsion very hard. Scratch resistance. Base of long wearing quality.
TITLE POSITIVE	205	For use in title cameras.	In title cameras for regular title cards and special effects. Clarity of the base is ideal for superimposed titles. Weston Tungsten Speed 4.
BACKGROUND PROJECTION POSITIVE	207	For background projection.	For background print use where procedures for fine grain have not been adopted. Positive emulsion with extremely accurate negative perforations. Weston 2.
FINE GROUND BACKGROUND PROJECTION POSITIVE	227	For background projection.	Made specifically for background projection. Extreme fine grain and high resolution; blue-black image of exceptional gradiation and sharpness.

*Also available on safety base.

EASTMAN MOTION PICTURE FILMS

35mm NEGATIVE

NAME	Type	USE	CHARACTERISTICS	Wratten Safelight	Code Initial	SPEED: WESTON Sun	SPEED: WESTON Tung.	SPEED: G. E. Sun.	SPEED: G. E. Tung.
PLUS X	1231	General production work, all classes of photography.	High speed, fine grain, full color sensitivity.	*Series 3	G	64	40	100	64
SUPER XX	1232	Studio interiors, newsreel, slow motion, adverse light conditions.	Extreme speed, medium grain, full color sensitivity.	*Series 3	H	100	64	150	100
BACKGROUND PAN	1213	Projection background, and process work.	Low speed, extremely fine grain, gray base.	*Series 3	B	10	6	16	10
BACKGROUND X	1230	Miniature work, process projection, extreme enlargements.	Medium speed, fine grain, balanced color sensitivity.	*Series 3	B	24	16	40	24
INFRA RED	1210	Night effects in sunlight, long distance and aerial photography.	Blue and infra red sensitivity, Wratten filters Nos. 15, 25, 29, 70, 87 and 89 recommended.	*Series 7	E		1.5		2.5
BI-PACK ORTHO-FRONT EXTERIOR	1234	Exterior scenes for 2 color process used with type 1235	Red dye ortho, medium speed, balanced for daylight.	*Series 2	A	6		10	
BI-PACK PANCHRO-BACK INTERIOR & EXTERIOR	1235	Used with type 1234 or 1236 for separation negatives, 2 color process	Panchro balanced in speed and color sensitivity, back film for 1234 or 1236	*Series 3	None				
BI-PACK ORTHO FRONT INTERIOR	1236	Interior scenes for 2 color process, used with type 1235.	Red dye ortho, medium speed, balanced for tungsten.	*Series 2	C		6		10

*Total darkness recommended. Safelight with 10 watt lamp can be used not closer than 3 feet for a few seconds after development is one-half complete.

EASTMAN MOTION PICTURE FILMS

35mm POSITIVE AND LEADER

NAME	Type	USE	CHARACTERISTICS	REMARKS
SOUND RECORDING	1357	For both variable area and variable density recording.	Medium speed, ultra violet or white light exposure. Standard positive perforations.	Safelight, Wratten Series O or OA; acetate base on special order. Available in footage numbered and frame line.
SOUND RECORDING	1301	For variable density recording with light valve.	Slower exposure; lower inherent noise level. Footage numbers.	Safelight, as above. Develop in low contrast negative developer. Standard positive perforations.
SOUND RECORDING	1302	For variable area recording.	Fine grain, positive emulsion. provided with footage numbers, lower noise level than 1357.	Safelight as above. Develop in high contrast positive developer. Clear nitrate base.
SOUND RECORDING	1372	For variable area recording.	Fine grain, low image distortion.	Standard 35mm, positive perforations. Footage numbered and frame-line marked.
SOUND RECORDING	1373	For variable density recording.	Fine grain improved recording.	Clear nitrate base. Also available on acetate base on special order.
NITRATE LEADER	No. 3	Developing machines; testing and projection.	Uncoated stock, positive perforations.	Title stock and machine leader .00538 in.
NITRATE LEADER	No. 6	Developing machines; testing and projection.	Blue-white stock; positive perforations.	Machine leader; oversize positive perforations; approximately 0.0075 in. thick.
SAFETY LEADER	No. 3	Developing and projection machines.	Transparent, uncoated stock; non-inflammable.	With or without positive perforations. Approximately 0.0055 in thick.
SAFETY LEADER	No. 6	Developing and projection machines.	Transparent, blue stock, non-inflammable.	Standard 35mm, positive perforations. Approximately 0.0075 in. thick.

EASTMAN MOTION PICTURE FILMS

35mm NEGATIVE AND POSITIVE

NAME	TYPE	USE	CHARACTERISTICS	Wratten Safelight	11 B Control Gamma	Dup. Neg. Exp. No.
DUPLICATING NEGATIVE	1203	General duplication master negatives	Extremely fine grain panchromatic sensitivity	Series 3	0.65	600
DUPLICATING NEGATIVE	1505	Master negatives for release positive.	Fine grain, low speed, Yellow dyed, blue sensitive.	Series 2	0.65	450
DUPLICATING POSITIVE	1355	Duplicate printing.	Lavender base medium, grain, good gradation.	Series O or OA	1.70	3000
DUPLICATING POSITIVE	1365	Duplicate printing	Fine grain, yellow dyed, high resolving power.	Series O or OA	1.40	Dup. Pos. Exp. No. 100
DUPLITIZED POSITIVE	1509	For making 2 color release prints.	Coated on both sides with yellow dyed emulsion.	Series O or OA	1.30	Rel. Pos. Exp. No. 700
RELEASE POSITIVE *	1301	Release prints, sound recording.	Low speed, clear base. Available footage numbers	Series O or OA	2.10	4500
RELEASE POSITIVE *	1302	General release and newsreel prints.	Fine grain, excellent definition.	Series O or OA	2.50	900
HIGH CONTRAST POSIT.	1363	For title, process and matte work.	Slow speed, high contrast.	Series O or OA	3.75	3000

*Supplied with footage numbers for sound recording.

COLOR TEMPERATURE

Cameramen and others who shoot color pictures know from experience that the color quality of a lamp or other source is referred to by its "Color Temperature." From the practical point of view, this refers to the degree of whiteness of the lamps or light and is specified by a special scale of temperature.

This scale is named after a British physicist, Lord Kelvin, and the degrees are 273° higher than the corresponding degrees Centigrade. They are denoted as degrees Kelvin or "°K."

Sources of light are usually divided into two classes, daylight and artificial light. Daylight is taken to mean sunlight mixed with light from clear blue sky. Artificial light is divided into two classes, —the incandescent lamps (tungsten filament, flash bulbs, arcs, oil lamps or candles) and the gaseous like the mercury lamp, Neon or other kind used for commercial advertising.

There are many ways by which the color of a lamp could be described, but the most practical is by the term "Color Temperature." The actual color temperature of a lamp in practice will depend upon the voltage applied and the age of the lamp, and the color temperature of a lamp varies with the voltage. As a rule the color temperature changes about 10° K for each change of one volt.

It is well known that the appearance of a colored object differs according to the kind of light by which it is viewed. For instance the difference between daylight and artificial light in their effect on the apparent color of a piece of cloth is so marked that it is customary to use special daylight lamps in examining cloth. There are however, differences between lamps which are more or less of the same kind, the extent of which depends on their type and wattage, their age and the voltage at which they are operated. These differences cannot always be detected by the eye, because it has the power of compensating for them, so that the lamps might all look equally white.

Color films do not possess this power of compensation and if the color of one lamp differs from that of another as a result of one of the causes mentioned, it may readily show up in the film, even though the eye does not detect a difference.

The most practical means of determining the color temperature of the various light sources, is with a Color Temperature Meter, which is designed to enable the amateur or professional cameraman to measure the quality of his illumination. It is important to be able to do this, because color films such as Kodachrome, are made to give correct color rendering for a definite color of light. If the illumination is not of the quality for which the film is balanced, the finished picture will be too warm or too cold. The Color Temperature Meter will enable the user to check his lamps for their color. If the readings show them to be different from that color for which the film is balanced, steps can be taken to compensate for this.

It should be noted, however,—that the color temperature meter, is not an exposure meter, it tells nothing about the level of illumination. The variations in the color of the light, are not measured in terms of exposure, but by adjusting the color of the light source to the type of film used.

The Color Temperature Meter is intended to permit control of the quality of light so the proper color balance is obtained in the final result and by carefully following directions given with the meter, excellent color results may be had .with the various types of color film.

KELVIN SCALE FOR PHOTOGRAPHIC USE
Color Temperatures from Various Light Sources

SOURCE	Degrees Kelvin
Iron Glowing—Dull Red	800
Candle Flame	1850
Ordinary House Vacuum Tungsten Lamp	2400
60 Watt Vacuum Tungsten Filament Lamp	2509
100 Watt Gas-filled Tungsten Filament Lamp	2865
500 Watt Gas-filled Tungsten Filament Lamp	2960
1000 Watt Gas-filled Tungsten Filament Lamp	2990
500 Watt Projection Lamp	3190
G.E. Mazda Lamp 3200° K	3200
Mazda C. P. Lamp	3380
1000 Watt Photoflood Lamp	3415
Photoflood Lamp No. 1	3444
White Fluorescent Mazda Lamp 3500° K	3500
Photoflash Lamp No. 21	3800
Superflash Lamp	4000
Early Daylight	4300
Late Daylight	4300
Daylight Photoflood Lamp	5000
White Flame Carbon Arc Lamp	5000
Mean Noon Sunlight at Washington, D.C.	5400
High Intensity Sun Arc Lamp	5500
Direct Sunlight in mid-summer may rise to	5800
Superflash Lamp No. 2B, 3B, 0B and 40B	6000
"Daylight" Fluorescent Mazda Lamp	6500
Mazda Flash Lamp No. 21B and 5B	6500

Some idea of the possible variation in the effective color temperature of daylight is given in the following:

Mean Noon at Washington, D.C.	5400
Direct sunlight about noon in mid-summer may rise to	5800
Sunlight plus light from clear sky about noon will be still higher, perhaps to	6500
Light from a totally overcast sky may be as high as	6800
Light from a hazy or smoky sky may range from	7500 to 8400
Light from clear blue sky	12,000 to 27,000
Direct sunlight early or late in the day in winter may drop to below	5000

The values in the above table may be taken as an approximate guide. The actual values obtained in practice will depend on the age of the lamp, voltage, and other conditions of operation. The nature of the reflectors and diffusers employed can exert a marked influence on the effective color temperature of the lilumination.

ANSCO COLOR CINE FILMS

Ansco Color Film for motion picture work is supplied in both the 16 and 35mm sizes.

Ansco Color 35mm Motion Picture Film

Ansco Color 35mm professional motion picture film is designated especially for use in commercial production where the characteristics of the taking or camera film are of significance only in so far as they concern the subsequent production of a satisfactory release print. As a result, since the film must meet only the requirements of a good original for printing purposes, such characteristics as color balance and gradation in the original can be adjusted in manufacture to yield prints of very high quality.

Ansco Colorpak (Type 735), should therefore be considered only as an original taking medium from which prints are to be made. *It is not itself satisfactory for projection.* In the first place, the gradation of Colorpak, Type 735, is considerably softer than that of ordinary reversible color film. Secondly, the film is intentionally manufactured to give a final result which may be, for example, too cold or bluish in color balance. When the release prints are made, contrast is increased and control of the color balance may be exercised by the use of filters in the printer so that the final print is characterized by excellent color rendition and gradation.

Ansco Colorpak, Type 735, is balanced for exposure by natural or simulated daylight, and in the studio it yields excellent results with high intensity carbon arcs in combination with Y1 Gelatin Filters or CP tungsten lamps filtered with Mac beth Whiterlite filters.

This material at present has a speed corresponding to a meter setting of approximately West 8 although higher speeds should soon be available. The developed original film is somewhat heavier than would be desirable for projection but this is necessary for optimum printing characteristics.

Processing of Ansco Colorpak can be carred out in conventional motion picture developing machines which have been adapted for the purpose. The modification necessary is not extensive and can be accomplished readily. Formulas and technical assistance in arranging for the processing of Colorpak are available from Ansco.

The release printing stock for use with Colorpak 735 is Ansco Colorpak Type 132. This can be processed on the same machines and in the same solutions as the original Ansco Colorpak, thereby avoiding additional installation expense. Printing of the Colorpak 735 onto the printing stock can be

carried out with ordinary contact printers provided some means is available for inserting color compensating filters into the optical system to adjust the color balance. The light source should operate at a color temperature of approximately 3000 K and a condensing lens system to concentrate the light at the aperture is helpful. Ansco Colorpak printing stock with the printing filters in place, needs from 2 to 4 times the light intensity called for when printing black-and-white positive fine-grain stock. As pointed out above, color compensating filters can be used to adjust the color balance of the final print.

When special optical effects, such as lap dissolves and wipe, are to be made, second generation duplicates of the original Ansco Colorpak will be needed. With color, each additional printing step tends to introduce noticeable degradation in color reproduction and where master dupes are necessary, there are two methods available for producing them with a minimum loss in color quality.

The first of these is to make a straight-forward print from the Ansco Colorpak original onto the duplicating stock and to then process the duplicate with considerably shorter than normal developing times in order to obtain soft gradation similar to the Colorpak original. The inevitable loss in color brilliance which results from this method precludes its recommendation for full length master dupes, but it is entirely suitable for the production of lap dissolves and other special effects where extremely accurate color rendition is not essential.

The second method of producing a master dupe makes use of a black-and-white silver mask on a special low shrink panchromatic film. In exposing the mask, a yellow filter is inserted in the optical system and the original is run on the negative head of the printer with the emulsion side toward the light source. The masking film runs on the printing head with its emulsion side toward the optical system in the normal way. The processed mask is then optically registered with the original and the two printed in contact with the Ansco Colorpak duplicating stock to make the master dupe. Master dupes prepared in this manner show little or no loss in color brilliance.

Negative sound tracks for ultimate printing on duplicating stock should be recorded on the opposite edge of the film, since the necessity of printing from a positive introduces a right to left reversal of the position of the sound track. This can be accomplished by moving the recording head of the sound equipment. When the negative track is printed onto positive stock, it will then be in the proper position for printing directly onto the Ansco Colorpak printing film.

The resultant dye track has a somewhat lower absorption in the infra-red region of the spectrum than silver tracks and for this reason there is a relative volume loss of about three decibles. This can be readily offset by a fader setting on most 35 mm projection equipment. A better solution is the use of the new blue sensitive photocells which are ideally suited for both silver and dye tracks with approximately the same volume so that no interchange of tubes is necessary. A cell of this type, currently supplied by RCA, is designated 1P-37.

Ansco Colorpak offers the professional motion picture industry the tremendous advantage of normal camera equipment; immediate and rapid processing of the film by the user so that color rushes can be viewed within a matter of hours; and all with the necessity of only minor changes in printing and nrocessing equipment.

Ansco Color 16mm Motion Picture Film

The 16mm film is balanced in gradation and color rendition so that the camera film is itself suitable after processing for projecton. If desred, duplicates can be made from this original on Ansco Color 16mm Duplicating Film (duplicating service is available from Ansco).

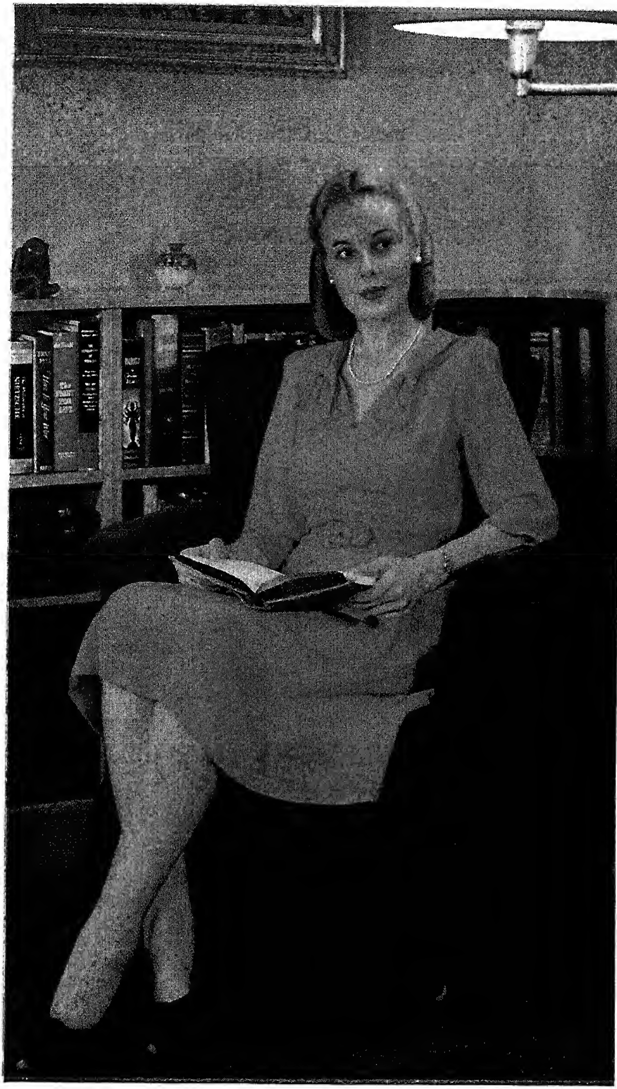
In exposing Ansco Color 16mm Motion Picture Film the general rules applicable to all color cinematography apply. The color quality of the illumination must be controlled, the brightness range of the subject matter should be within the limits suitable for color photography and the exposure should be kept as nearly correct as possible.

The film is supplied in two types, one balanced for use in daylight and the other balanced for either 3200 K illumination or photoflood lamps. Although results obtained on the tungsten type film under photoflood lamp illumination will be slightly colder than those yielded by the same film with 3200 K lamps, the difference can usually be disregarded. An exception would be when scenes are interspliced so that a direct comparison is inevitable.

The meter settings recommended by Ansco for the two types of film are as follows:

	Weston	*G.E.*
Daylight	8	12
Tungsten	12	16

These settings and the data given in the tables below should be considered merely as basic guides to be modified in the light of experience. There are inevitable variation in the efficiency of various items of equipment such as lenses and shutters as well as in the techniques followed by individual photographers. Therefore slightly higher or lower meter settings may be found preferable in the light of personal experience under a given set of working conditions.



Ansco Color Film—Tungsten Type

Daylight Exposure Guide for Ansco Color Film, Daylight Type

Important—Exposure in the following table are suggested for use under average summer conditions in the Temperate Zone, from two hours after sunrise until two hours before sunset.

In winter, use next larger lens opening (one full stop) rather than that given in the table, provided there is no snow.

With exceptionally brilliant light, as in seascapes, snow scenes, or at high altitudes, the indicated exposures may be halved.

The exposures in the table are for medium subjects. Dark subjects require one-half stop greater exposure, while light subjects should be given one-half stop less exposure.

Normal Shutter Speed of 16 Frames per Second

	Front Lighted	Side Lighted	Black Lighted or Open Shade
Bright Sunlight	f.8	f.5.6	f.4
Hazy Sunlight, Soft Shadows	f.5.6	—	—
Sun Overcast, Bright Day, No Shadows	f.4	—	—
Sun Overcast, Dull Day	f.2.8	—	—

Exposure Guide for Ansco Color Film, Tungsten Type With 3200 K Lamps or No. 2 Photoflood Lamps

This table is based on exposures for average subjects in light-colored surroundings. A dark-colored subject will require a half-stop or greater increase in diaphragm opening. A light-colored subject will require about one-half stop smaller diaphragm opening. Because of differences in reflectors, the table is given only as a guide. In order to utilize the full output of light from the lamp, a reflector of good quality should be used.

500-Watt 3200 K Mazda Lamps or Photoflood Lamps (In Reflectors)

For Average Colored Subjects in Light-Colored Rooms
Normal Shutter Speed of 16 Frames Per Second
Lamp to Subject Distance in Feet

	4′	6′	8′	10′	12′
1 lamp	3.5	2.8	2.5	2	1.8
2 lamps*	4.5	4	3.5	2.8	2.5

*When two lamps are used, the exposures in the table are correct only if both lamps are close to the camera, and the light from both of them must be superimposed on the subject.

The brightness range which can be satisfactorily recorded in color is somewhat less than that suitable for black-and-white photography. Furthermore, contrasts between highlights

Ansco Color Film—Daylight Type

and shadows are less necessary because the colors of the subject serve to differentiate between its various component elements. Outdoor shots in brilliant sunlight can frequently be improved by the use of a white or neutral foil reflector to illuminate shadow areas. Indoor lighting need not be absolutely flat but should be even and have less contrast between highlight and shadow areas than is usual for black-and-white work. A lighting technique which has proved very satisfactory is to flood the entire subject evenly with light from the direction of the camera and to then superimposed on this main or basic lighting any side, top or back lights which may be considered desirable.

Two series of filters are available for use with Ansco Color Film. The first of these are ultraviolet absorbing and are supplied in three densities. From the lightest to the heaviest they are; the UV-15, UV-16 and UV-17. For ordinary haze correction or the elimination of excessive ultraviolet radiation at high altitudes and over water the UV-16 is recommended. The UV-15 provides less correction and the UV-17 more.

The second series of filters, known as the conversion filters No. 10 and No. 11, are for exposing daylight type film under 3200 K illumination and tungsten type film in sunlight. The No. 10 for daylight film indoors requires an exposure increase of four times over that necessary with tungsten film under the same conditions. The No. 11 filter with tungsten film in daylight needs 1½ times the exposure for daylight film.

Because the gradation characteristics of the two film types differ (the daylight film has higher contrast than the tungsten type) it is ordinarily desirable to use each film only under the conditions for which it was manufactured. There are exceptions to this recommendation, however. For example, the slight speed disadvantage of tungsten film outdoors may be offset under some conditions by the usefulness of its softer gradation. This applies especially to harshly lighted closeups in bright sunlight where the shadow areas are large and of relatively low luminosity.

16mm Ansco Color Film in lengths less than 200 feet is sold only with the cost of processing included and films may be returned to Ansco, Binghamton, New York for processing free of charge. Ansco does not recommend that users of the film attempt to process it themselves on home developing equipment such as that used for black-and-white reversible films, because of the difficulty of temperature control, or preventing excessive areation of the solution, and of giving a satisfactoritly uniform second exposure. However, motion picture processing machines of the commercial type can be adapted to handle Ansco Color Film. Information on this point as well as the formulas recommended for the processing are available from Ansco, Binghamton, New York.

ANSCO COLOR REVERSIBLE PRINTON

Ansco Color Reversible Printon is designed especially for making color prints directly from color transparencies. It consists of a white opaque film base material on which are coated emulsion and filter layers, so that the final result is similar to an integral tri-pack color film, such as Ansco Color Film.

Prints can be made from transparencies by contact printing or enlarging directly onto Printon with a single exposure. No separation negatives are necessary. Following exposure, Printon is processed with the chemicals supplied in the Ansco Color Reversible Printon Developing Outfit. The resulting finished print closely resembles the original transparency in color rendition. The user should not expect to duplicate his transparency exactly, however, because as in all color printing processes which do not employ masking, there are minor losses in color saturation.

EQUIPMENT—An ordinary enlarger or contact printer can be easily adapted for use in making Printon color photographs. Additional equipment required consists of the following filters—an Ansco Color UV-18, a Corning Aklo No. 3962, and ten Ansco Color compensating Filters as follows:

(1) Yellow 23	(1) Magenta 33	(1) Cyan 43
(1) Yellow 24	(1) Magenta 34	(1) Cyan 44
(1) Yellow 25	(2) Magenta 35	(1) Cyan 45

With enlargers which already contain a heat-absorbing glass, the Aklo filter is unnecessary.

As a light source, a General Electric No. 212 Photo-enlarger lamp, operated at 100 V., is recommended, though other light sources which yield a color temperature of approximately 2950° K. may also be used. If the No. 212 Photo-enlarger lamp is employed, it should be replaced by a new one at the end of 20 hours' burning.

The Aklo glass and the UV-18 filter are standard for all exposures. Since the purpose of the Aklo glass is to protect the gelatin filters and the transparency from excessive heat, the Aklo glass should always be placed nearest the light source with the gelatin filters between it and the transparency. When enlargements are being made, the color compensating filters must be placed between the Aklo glass and the transparency rather than in front of the projection lens. Such an arrangement prevents inter-surface reflections and scattered light from affecting the print.

SAFELIGHT—Ansco Color Printon may be handled and developed under green safelight, such as the Ansco A-3 filter, or equivalent, with 10-watt lamp. Do not allow safelight to strike the paper directly. A flashlight with a dark green filter, such as the Ansco A-3 filter, cut to fit inside the lens, is a convenience in printing and developing, but it should not be flashed directly on the Printon. Greenish black fog in finished prints may result from unsafe darkroom illumination.

EXPOSURE AND COLOR BALANCE ADJUSTMENT—With each package of Ansco Color Printon there is furnished on the label a set of numbers which specify the color correction filters for that emulsion. These filters, with the equipment described above, should yield a satisfactory print of approximately the correct color balance.

ANSCO COLOR REVERSIBLE PRINTON

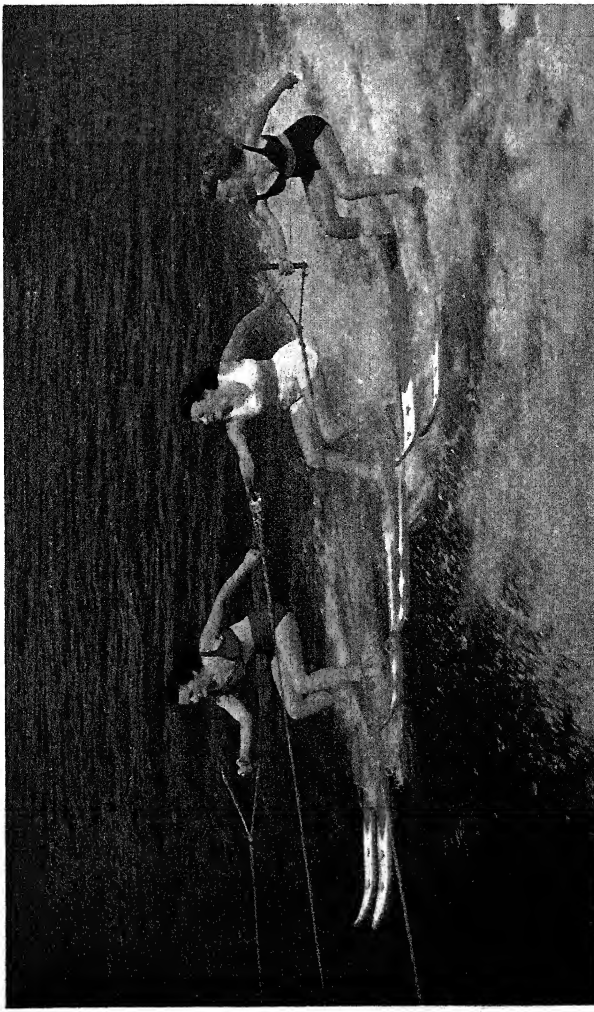
Ansco Color Reversible Printon produces color prints directly from color transparencies, using standard enlarging or contact printing equipment in which the color quality of the light source is adjusted with filters, then by special development with chemicals supplied in the Ansco Color Reversible Printon Development Outfit.

With each package of Ansco Color Reversible Printon, there is furnished the recommended filters for correct color balance and is based on tests made using G. E. #212 bulb, the Aklo #3962 and Ansco UV-16 filters. This will serve as a guide, but for best results on the user's equipment, tests should be made as given in the instruction sheets supplied with each package.

PROCESSING PROCEDURE

Step	*Treatment*	*Remarks*	*Temp. in °F.*	*Time in Min.*	*Total Time*
1	First Developer	Agitate every 15 seconds	68°	12 min.	12 min.
2	Short Stop	Agitate Normal	65° to 75°	3 min.	15 min.
	Room lights may now be turned on. (No strong daylight.)				
3	Wash	Running Water	65° to 75°	3 min.	18 min.
4	Reversal Exposure	G.E. #212 Bulb in reflector at 2 feet		3 min.	21 min.
5	Color Developer	Agitate every 15 seconds	68°	12 min.	33 min.
6	Sulfate Rinse	Agitate Normal	60° to 75°	1 min.	34 min.
7	Hardner	Agitate Normal	60° to 75°	5 min.	39 min.
8	Wash	Running Water	60° to 75°	10 min.	49 min.
9	Clearing Bath	Agitate Normal	60° to 75°	3 min.	52 min.
10	Bleach	Agitate Strong	60° to 75°	10 min.	62 min.
11	Wash	Running Water	60° to 75°	5 min.	67 min.
12	Fixer	Agitate Normal	60° to 75°	5 min.	72 min.
13	Wash	Running Water	60° to 75°	15 min.	87 min.

Dry on rack or hangers. Do not ferrotype or heat.



Ansco Color—Printon

BIPACK COLOR

Bipack is the most economical process of natural-color cinematography available today. While it is a two-color system and subject to limitations in its color rendition, it can with proper care produce excellent results, and its simplicity and economy are such as to commend its use for all purposes where color is needed and circumstances do not warrant the higher cost of three-color methods. A further advantage is the fact that bipack is not a proprietary process, and negative processing and printing may be done by any of several laboratories, including Cinecolor, Magnacolor (Consolidated Film Industries), and others in Hollywood, and by several firms abroad.

Bipack may be photographed in any standard camera, such as the Bell & Howell, Mitchell, Wall, Duplex, etc. Two films are used, passing through the photographing aperture face-to-face. The front film is orthochromatic, to record the blue-green portion of the picture. Its surface carries a red dye equivalent in color-transmission to a Wratten 23-A filter. The rear film is panchromatic, and being photographed through the red coating of the front film, records only the red-orange components of the picture. Bipack negative is made in this country by both Eastman and DuPont, and by several firms abroad. Best results are had by considering the Weston speeds of the bipack films, used in combination, as 8 to daylight, and 6 to Mazda light. No filtering is necessary either for exterior or interior photography, as all necessary color corrections are made by adjusting the development of the two negatives and the two printing operations.

Since the image must be focused on the plane of contact of the two negatives used, lenses and focusing screens used in bipack photography must be readjusted to throw the plane of focus .006 inch back of the normal (black-and-white) plane.

No readjustment of pilot-pins or claws is necessary as a rule, but the tension of aperture pressure-plates or rollers must be accurately regulated so that there will be sufficient pressure to keep both films in absolute contact, but not so much as to prevent free movement of both films between exposures. Such adjustments should be made only by the factory or by camera mechanics experienced in bipack technique.

In the field, the cameraman should make frequent hand-tests, which will show whether or not he is getting good contact between his two negatives. Lack of contact can be detected by out-of-focus areas where one film or the other has bulged toward or away from the lens. Excessive pressure is usually revealed by torn perforations.

Special magazines or adapters must be provided to accommodate the two films.

Care should be taken to avoid photographing objects of purple, lavender or pink coloring, as the process cannot reproduce these colors. Aside from this and an occasional lack of absolute fidelity inevitable by want of the third color component, bipack, properly exposed and processed, gives pleasing results. The most natural effects are had by avoiding strong color contrasts, by giving a slightly full exposure and working for soft tones.

CINECOLOR—TWO COLOR

For two color action pictures, Cinecolor advises the use of the Bi-Pack method of photography, wherein two color-value negatives are used in a standard camera such as Bell & Howell or Mitchell. The two negatives are thread in the camera with their emulsion surfaces in contact. Since the images are thus photographed through the celluloid side of the front negative, the actual point of focus is approximately .006 inch rearward from normal black and white photography and, therefore, for eye focus the focal plane of the focusing glass must likewise be moved rearward .006 inch and for lens focus the lens barrels should be re-calibrated to accommodate the change in focus. Bi-Pack consists of two negatives. A film magazine, therefore, must be used that will accommodate two rolls of negative instead of one and these are obtainable on the market.

The front film of the Bi-Pack pair of negatives is orthochromatic and the rear film panchromatic. On the surface of the front film is a coating of red dye which acts as a filter and prevents the color values which are photographed onto the front film from recording onto the rear film.

Since the camera gate must accommodate two negatives, the gate itself must be adjusted to allow the two films to pass through without undue pressure, but it is important that the emulsion surfaces of the two negatives are in perfect contact at the time of exposure. Incorrect pressure of the two negatives will result either in the rear negative being unsharp or torn perforations. After the Bi-Pack negatives are developed it is possible to make 35mm, 16mm and 8mm prints.

GASPARCOLOR

The Gasparcolor paper represents a simple means of making prints from color transparencies in one operation with a single exposure and therefor eliminating the necessity of three color separation Negatives.

The process can be carried out in the normal manner of making black-and-white prints with only a few additional solutions and a little more time.

In practice you place your color transparency in the enlarger, your Gasparcolor paper on the easel, and expose. After exposure, it is developed, fixed, dye-bleached, silver-bleached and fixed with intermittent washes.

The first two operations are the same as in any ordinary black-and-white work, silver images of varying densities are formed in three layers. In the next solution (the dye bleach) the dyes are locally bleached away in straight proportion to the silver image present in each layer.

The next step in the processing is the removal of the remainder of the metallic silver, still present in the layers, by bleaching it to silver chloride and fixing it. After final washing the print is ready to be dried, showing full and brilliant color.

KODAK EKTACHROME FILM

Kodak Ektachrome film is a multi-layer sheet film having dye couplers incorporated directly in the emulsion layers, producing positive color transparencies of superb quality quickly and with safety in processing. Transparencies are moderate in contrast, yet exceptionally brilliant. Faithful color rendering throughout highlight and shadow areas produces extremely lifelike results, enabling flesh tints to be faithfully produced. Since the coupler components of the dyes are placed in Ektachrome Film during manufacture, only one color developer is required to produce three differently colored dye images which form the full color reproduction of the subject. Processing has been simplified where it can be performed in any darkroom with standard equipment.

There are two types of Ektachrome Film. Daylight type for use in sunlight or with daylight (blue-bulb) Photoflood Lamps and Type B for use with 3200K tungsten filament lamps. For exposing Type B with Photoflood Lamps the Kodak Color Compensating Filter CC13 should be used. With Photoflash Lamps No. 5, 6, 11 ,22, 31 and 50, which give a slightly bluer light than Photoflood Lamps, the Kodak Compensating Filter CC95 is recommended. The Type B film can also be exposed in daylight with Wratten Filter No. 85B. Read the full instructiions given in the package containing the film.

The steps for processing Kodak Ektachrome Film are not complicated, and no special equipment other than six tanks and an accurate thermometetr is necessary. First, the film is developed to a black-and-white negative; then it is hardened, exposed for reversal (before washing) and redeveloped for color in a dye-coupling developer. Following color development, the film is cleared in a clearing and fixing bath, bleached to remove silver, and fixed in the same bath used for clearing.

These steps, plus the necessary rinses and washes require a total processing of about 90 minutes. However, only 19 minutes are spent in darkness; the remainder of the process is carried out in normal room illumination.

The only step which requires close control of temperature is first development. Here variations of more than ½° F from the standard temperature of 68° F should not be allowed, and the use of an accurate thermometter such as the Kodak Process Thermometer is recommended. The other solutions may be used at 66° to 70° F, while the wash water may be used at 65° to 72° F. Care should be taken not to allow the solutions to contaminate one another.

COLOR FIDELITY →

Ektachrome Film's faithfulness of color reproduction, in low as well as high key lightings, broadens the photographic illustrator's horizons.

All color work is exacting work. While it may be possible to make some good color transparencies by the "watch-it-come-up" method, day-in-and-out consistent results require strict attention to time and temperature recommendations.

It is especially important that you avoid letting any of the Clearing and Fixing Bath get into the First Developer, Hardener, or Color Developer. Reserve certain tanks for Ektachrome processing and use the same tank for the same solution each time new chemicals are mixed. The possibility of contamination will be greatly reduced if the solutions are mixed in the processing sequence—that is, First Developer then Hardener, etc. Agitation is very important. When film is lowered into the First Developer give them a few quick taps against the inside of the tank to remove air bells. Then lift each hanger with film entirely out of the developer (this also applies to the other solutions) once every two minutes, drain for five seconds and return it to the solution. With each lifting, drain the film alternately from each of the bottom corners.

CAUSES OF IMPROPER COLOR BALANCE

When lighting and processing directions are followed implicitly, the finished transparencies will bear an amazing color likeness to the original subject. Errors, however, have a way of creeping in—especially in processes that are so often practiced that they become habit.

Below are listed several off-color possibilities, with their common causes:

Bluish results:

- Solutions improperly mixed.
- Solutions used below temperature tolerance.
- Use of Type B film with Photoflood Lamps.
- Type B film with Photoflash Lamps but without the CC95 filter.
- No reversal exposure.
- Processing solutions too cold.

Bluish-green results:

- Processing solutions much too cold.
- Type B film used outdoors without the 85B filter.
- Washing between hardener and reversal exposure.

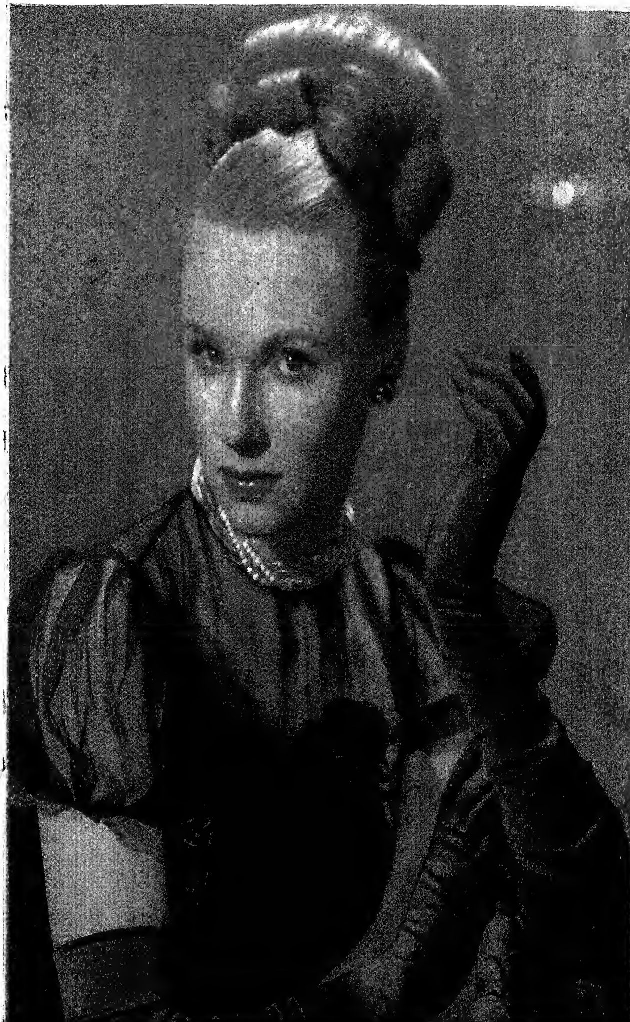
Yellowish results:

- Failure to use the Clearing and Fixing Bath before the Bleach Bath.

Reddish results:

- Daylight film used with 3200°K light source.

Surface scum or emulsion side—inefficient washing following the First Developer.



CONTRASTS OF COLOR

Soft, creamy flesh tones, in proximity with strong vibrant colors—each retain their beauty and brilliance in the Ektachrome transparency.

PROCESSING PROCEDURE

AGITATION: While it is in each of the solutions, *agitate the film once every 2 minutes by lifting it entirely out of the solution and drainiing it for 5 seconds from one corner.* Drain the film alternately from each of the bottom corners.

TEMPERATURE: The First Developer should be used at 68° F. Good results depend on accurate control at this stage of the processing, and variations of more than ½° F from the standard temperature should not be allowed. The other solutions may be used at 66° to 70° F, while the wash water may be used at 65° to 72° F.

1. DEVELOP the film in the First Developer. After adjusting the temperature of the First Developer to 68° F, turn out all lights and load the film in the developing hangers. Place the film in the First Developer and begin timing the operation. At the end of 15 minutes drain the film for 5 seconds and proceed to Step 2.

2. RINSE the film for 1 minute in running water at 65° to 72° F.

3. HARDEN the film in the Hardener for 5 to 10 minutes at 66° to 70° F. After the film has been in the Hardener for 3 minutes, the room lights can be turned on and left on for the rest of the processing. *Do not place the film in the wash water until after the reversal exposure.* Washing the film before the reversal exposure will result in the transparency having a greenish color.

4. REVERSAL EXPOSURE. Remove the film from the Hardener and expose each side for at least 5 seconds to the light of a No. 1 Photoflood Lamp placed 1 foot from the film, or hold the film for at least 5 seconds between two No. 1 Photoflood Lamps located 2 feet apart.

CAUTION: In use, Photoflood Lamps become quite hot and will shatter if any liquid is allowed to splash on their surfaces. Place sheets of glass where they will protect the lamps from spatttering or splashing of the solutions or wash water.

5. WASH the film for 5 minute in running water at 65° to 72° F.

6. COLOR DEVELOPMENT. Develop the film for 25 minutes in the Color Developer at 66° to 70° F.

7. WASH the film for 5 minutes in running water at 65° to 72° F.

8. CLEAR the film for 5 minutes in the Clearing and Fixing Bath at 66° to 70° F. *Save this solution for use in Step 12.*

9. RINSE the film for 1 minute in running water at 65° to 72°.

10. BLEACH the silver image by treating the film for 10 minutes in the Bleach at 66° to 70° F. See the warning on the label.

11. RINSE the film for 1 minute in running water at 65° to 72° F.

12. FIX the film for 5 minutes in the Clearing and Fixing Bath at 66° to 70° F. Use the same solution used in Step 8.

13. WASH the film for 10 minutes in running water at 65° to 72° F.

14. REMOVE WATER DROPLETS by bathing the film in a solution of Kodak Photo-Flo for 1 minute at 65° to 72° F, or by wiping the film off with a Kodak Photo Chamois or a soft sponge. The Photo-Flo treatment is preferable because it eliminates any danger of damage to the emulsion and facilitates uniform drying.

15. DRY the film in the usual manner. Until the film is dry, it appears somewhat opaque, the front appearing reddish and the back bluish. This does not indicate improper fixing; the dry transparency will be clear. When viewing the wet transparency, remember that it will be slightly colder in hue when dry.

SUMMARY OF STEPS FOR PROCESSING KODAK EKTACHROME FILM

Step	Solution or Procedure	Remarks	Temp. in °F.	Time in Min.	Total Min. at End of Step
1	First Developer	Temperature tolerance ±½° F. Agitate carefully according to instructions.	68°	15 -	15
2	Rinse	Running water.	65°-72°	1 -	16
3	Hardener	Room lights can be turned on after 3 minutes. Five minutes' hardening is sufficient, but up to 10 minutes will do no harm. The 5- to 10-minute tolerance allows for delays caused by the reversal exposure between the Hardener and the 5-minute wash.	66°-70°	5-10	21-26
4	Reversal Exposure	Expose each side for 5 seconds at 1 foot from a No. 1 Photoflood Lamp. *Do not place in wash bath until after exposure.*			Reset Timer to Zero
5	Wash	Running water.	65°-72°	5 -	5
6	Color Developer		66°-70°	25 -	30
7	Wash	Running water.	65°-72°	5 -	35
8	Clear	Clearing and Fixing Bath. Same bath for us in Step 12.	66°-70°	5 -	40
9	Rinse	Running water.	65°-72°	1 -	41
10	Bleach				
11	Rinse	Running water.	66°-70°	10 -	51
12	Fix	Clearing and Fixing Bath.	65°-72°	1 -	52
13	Wash	Running water.	66°-70°	5 -	57
14	Remove water droplets	Use Kodak Photo-Flo or wipe carefully.	65°-72°	10 -	67
15	Dry	Same method as black-and-white films.	65°-72°	1 -	68

KODACHROME FILM

Kodachrome film carries three emulsions on one face, separated by gelatin layers. The emulsion nearest the film base responds to red light, the middle emulsion to green, and that at the surface to blue. A yellow dye above the middle emulsion prevents blue light from reaching the two lower emulsions, since these are also sensitive to blue, in addition to green and red respectively. The layers, so thin that their total thickness scarcely exceeds that of the emulsion layer of a black and white film, are coated on safety film base having an antihalation backing.

The picture on the top emulsion is taken by blue light, on the middle emulsion by green and on the bottom emulsion by red light. This is not accomplished by blue, green and red filters, but in the following way: The top emulsion is sensitive to **blue** light only, the **green** and the **red** light pass through it without affecting it, so that the **blue** light alone makes the exposure. The yellow dye (mentioned above) prevents any **blue** light from reaching the two lower emulsions. The middle emulsion is sensitive to **green** but not to **red.** It is sensitive to **blue** as all emulsions are, but the **blue** light cannot reach it, and the **red** light passes through without affecting it. Therefore, the exposure is made by **green light.** The bottom emulsion is sensitive to **red** but not to **green.** It is also sensitive to blue, but the **blue** light cannot reach it, and the **green** light does not affect it. Hence, the picture is taken by **red** light alone.

After exposure all three emulsions are first developed to negatives. The metallic silver in the negatives is removed by a bleach which dissolves the silver but the residual bromide which has not been developed because it was not exposed is left in the film. Then the film is re-exposed and developed in "coupler developers" so that in the final result the negative silver images are replacd by positive silver and dye images.

A coupler developer differs from ordinary developers in that it not only converts exposed silver bromide to metallic silver, but at the same time, deposits a dye of a predetermined color along with the silver. The silver is then dissolved away, leaving only the dye images. The top layer is now an image in yellow dye, the middle one a magenta image, and the bottom one a blue-green image. These colors, it will be noticed, are complementary to the colors to which the emulsion layers were originally sensitive. Where the emulsion was strongly exposed, there is practically no dye. Where the emulsion was not exposed, there is a full quantity of dye.

The final image is so balanced in color that Kodachrome regular, or Daylight Type, when projected with a high-efficiency tungsten lamp, resembles in color the original subject as it was seen in daylight. The relation among red, green and blue speeds of these films is correct for sunlight photography. The color balance of Type A and Type B is such that when the final image is projected the colors approach those of the original subject as seen by the eye in daylight.

KODACHROME FILM

For Motion Picture and Miniature Cameras

The chart shown on the next page applies to Kodachrome Color Film as used in 16mm or 8mm motion picture cameras operating at 16 frames per second*, or for miniature cameras with a shutter exposure of 1/26 second**, and is for daylight pictures from two hours after sunrise until two hours before sunset, with Kodachrome Film K135 without filter or Kodachrome Type A Film with Type A Filter.

The Type A Filter must be used for day scenes with Kodachrome Type A Film. The same exposure is required ah for Kodachrome Film K135 without filter.

The Kodachrome Haze Filter improves color rendition in pictures made on dull days, in shade or extremely distant views, snow scenes or pictures in high altitudes. With Kodachrome Film K135, no increase in exposure is required. The Haze Filter is unnecessary when using Type A Film with Type A Filter.

The Pola-Screen Type 1A will give very effective color shots of light colored objects or people against blue sky if photographed in side lighting. Will also subdue oblique reflections on metal, glass or water scenes and will soften harsh lighting. Increase in exposure is necessary of at least one and one-half stops.

Light colored objects include beach and water scenes, desert shots, light colored flowers, buildings, people in light colored clothes, shots against the sky, etc.

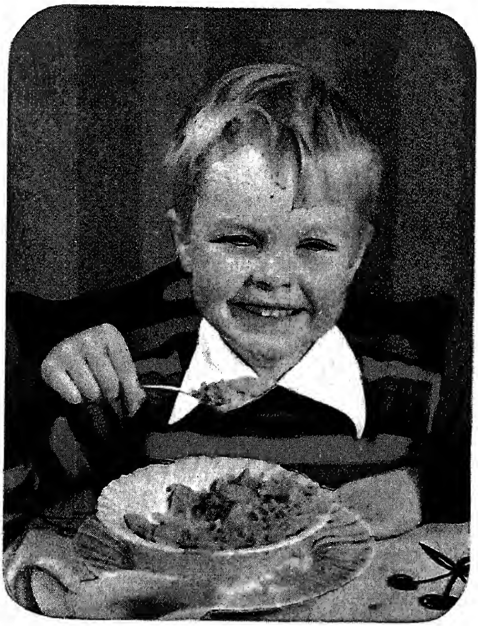
Dark colored objects include heavy foliage, deep colored flowers, dark animals, subjects shaded, people in dark clothing, dark colored automobiles, etc.

Medium colored objects include dark and light objects in equal proportions, dark streets with light buildings, close-ups of people in medium colored clothes.

Whenever there is any doubt as to the color of the object, use the center column showing medium colored objects. Best results are obtained in direct sunlight with exposure as near correct as possible. Under-exposure gives dark deep heavy colors with no detail in the shadows. Over-exposure gives pale, light and washed out colors. Exposed film should be processed as soon after exposure as possible for best color results.

*For lens stop conversion to other speeds see page 235.

**For conversion to other shutter exposure see page 202.



Kodachrome—Tungsten Type

KODACHROME EXPOSURE CHART

SHOWING LENS OPENING FOR VARIOUS LIGHT DENSITIES

For Kodachrome Regular Without Filter or Kodachrome Type A with Type A Filter

LIGHT DENSITY	FLAT LIGHTING Sun Behind Camera Direct on Subject			SIDE LIGHTING Sun at Right Angle to Camera			BACK LIGHTING Sun Behind Subject with Lens Shaded			OPEN SHADE Subject Lighted by Open Sky—No Sun		
	Light Colored Objects	Medium Colored Objects	Dark Colored Objects	Light Colored Objects	Medium Colored Objects	Dark Colored Objects	Light Colored Objects	Medium Colored Objects	Dark Colored Objects	Light Colored Objects	Medium Colored Objects	Dark Colored Objects
EXTREMELY BRIGHT SUN	F.16	F.12.5	F.11	F.11	F.9	F.8	F.8	F.6.3	F.5.6	F.5.6	F.4.5	F.4
BRIGHT SUN	F.11	F.9	F.8	F.8	F.6.3	F.5.6	F.5.6	F.4.5	F.4.	F.4	F.3.2	F.2.8
HAZY SUN	F.8	F.6.3	F.5.6	F.5.6	F.4.5	F.4	F.4	F.3.2	F.2.8	F.2.8	F.2.3	F.1.9
CLOUDY BRIGHT	F.5.6	F.4.5	F.4	F.4	F.3.2	F.2.8	F.2.8	F.2.3	F.1.9			
COUDY DULL	F.4	F.3.2	F.2.8	F.2.8	F.2.3	F.1.9						

Based on 16 Frames per Second for Cine Cameras, or 1/25 Second for Miniature and Still Cameras.

Kodachrome—Daylight Type

COMMERCIAL 16mm KODACHROME

With duplicate prints, rather than the original, being the principal factor, it is very important that the original from which these prints are made, be of the highest quality. They should have good consistant color, proper contrast, sharpness, steadiness and have well-modeled highlights with a density value of 0.35 or more. The highest density should not exceed 2.0 and in order to avoid any slight variation in emulsions, all the film to be used on a production, should be obtained at the same time. For the same reason, if practical, all the film should be returned for processing in one package. Exposed rolls should be protected from high humidity and in hot weather should be refrigerated.

Kodachrome Type A, requires lighting of low contrast and all lamps must have the same definite quality of illumination, and since it is color balanced for 3450 °K, it should be used as close to that rating as possible. Increasing the voltage on tungsten lamps raises the color temperature and makes the light bluer; decreasing the voltage, drops the color temperature. All lamps should be operated at 3450 °K, but if this is not possible, a compensating filter should be used over the camera lens. The color temperature can be checked with a color meter. Blue filters to raise the color temperatures are CC3 light, CC4 and CC5 medium and CC6 dark. Yellow filters to lower the temperature are CC13 light, CC14 medium and CC15 dark.

An illumination level of 650 foot candles is required for Kodachrome Type A, 24 frames at F.2.8. For other apertures see chart on next page or page 189. It is important that all colors be uniformly lighted, since in color photography it is the difference between colors that provide the color contrast. This means that front lighting should be used, except when the subject is all of one color, or contains no color contrast, then side or back light can be used. The key light should be placed first and the fill-in lamps be set last.

The use of a reliable exposure meter measuring the (incident light) light on subject is recommended.

Kodachrome Film for daylight is color-balanced for the mixture of sunlight and skylight which prevails during the day. Early morning or late afternoon the light is usually too yellow. Direct and hazy sunlight are best for nearly all purposes. Open shade lighted by blue sky will be blueish. The ratio of sunlighted highlight to skylighted shadow is usually too high for good color rendition, therefore suitable reflectors should be used to direct light into the shadow areas and reduce the contrast. For this purpose hard and soft reflectors can be used. Aluminum paint, tin foil, mirrors, white oil cloth or white cardboard can be used. For interiors of offices, factories and the like, illuminated by daylight, additional lighting is required which matches daylight in color. Regular Kodachrome must be used. One suitable illuminant is the carbon arc-lamp, fitted with white flame carbons and the Brigham Y1 Filter, another is the Mazda C.P. lamps with Whiterlite Filters over the lamps. The carbon lamps supply a higher illumination level, the Mazda lamps, a more constant color source. Another choice is the Blue Photoflood lamp, which will provide good color balance, but should not be used when flesh tones are part of the scene.

Correct exposure can be determined by the use of any good photo electric exposure meter. Considerable thought should be given to the selection of the colors of props and backgrounds. Some colors do not photograph exactly as they appear to the eye and tests should be made before starting production. The use of light and medium grays adds to the naturalness of color film. Brilliant whites or blacks should be eliminated whenever possible.

KODACHROME SAFETY FILM TYPE A 16mm

This film is color-balanced for use with Photoflood Lamps, of 3450 °K. Perforated on both sides for silent, or one side for sound cameras.

METER SETTINGS	WESTON	G.E.
PHOTOFLOOD LAMPS	12	20
SUNLIGHT, with Type A Kodachrome Filter for Daylight	8	12

ILLUMINATION (Incident Light) in foot candles for Movies & Stills:

Lens Aperture		F.1.9	F.2.8	F.4	F.5.6	F.8
	Sound 24 frames	300	650	1300	2600	5200
Type A Kodachrome 16mm	Silent 16 frames	200	435	870	1740	3500
Kodachrome Professional Type B	1/10 sec.			750	1500	3000
(Bellows draw 1.2)	1 sec.			75	150	300
Miniature Kodachrome K135A, K828A	1/25 sec.	150	325	650	1300	2600
	1 sec.	6	13	26	52	104

This table is for average subjects containing light, medium and dark colors. If subject is composed entirely of very light colors, use one-half stop less; if colors are entirely dark, use one-half stop more.

KODACHROME SAFETY FILM (FOR DAYLIGHT) 16mm

This film is color-balanced to a mixture of sunlight and skylight from two hours after sunrise and up two hours before sunset. Perforated on both sides for silent cameras or one side for sound cameras.

METER SETTINGS	WESTON	G.E.
SUNLIGHT	8	12
PHOTOFLOOD, with Kodachrome Filter for Photoflood (not recommended)	3	5

Daylight exposure table: For 24 frames per sec. Shutter time 1/45 sec.

Basic Exposure-Front Lighting				Side or Back-lighting Average Subjects
LIGHTING	Average Subjects	Light Colored Subjects	Dark Colored Subjects	For lighting effect; without reflectors ½ stop more. With reflectors—about same as front lighting.
Bright direct sunlight	F.6.3	F.8	F.5.6	For full shadow detail, allow one stop more.
Weak hazy sun, no distinct shadows	F.4.5	F.5.6	F.4	Adjustment must also be made for light and dark colored subjects—½ stop more or less as the case may be.
Overcast sky, cloudy but bright	F.3.5	F.4	F.2.8	
Open shade, bright day	F.2.5	F.2.8	F.2	

Film Sizes for Commercial Work:

Perforated both sides	50 ft.	100 ft.	200 ft. Rolls
Perforated one side	100 ft.	200 ft.	400 ft. Rolls

ROTOCOLOR

Rotocolor is a system beginning with a camera and an optical printer of radically different design.

The Rotocolor camera photographs pictures on their "side." The 16mm Kodachrome film travels horizontally instead of vertically as in all other motion picture cameras now in use, thus obtaining a picture more than twice the usual 16 mm image size. In fact, the image needs but slight enlargement to the standard projection aperture in the Rotoclor Optical Printer, resulting in the highest quality yet utilizing the lighter weight and safety factor of Kodachrome or similar color stock.

In the Rotocolor Optical Printer as in the camera the original 16mm Kodachrome moves horizontally, while the 35mm film (or films) travels in the conventional vertical. Sixteen mm. prints or negatives are reduced in the same manner.

At sound speed of 24 frames per second, conventional 16mm cameras pull film past the aperture at 36 feet per minute, the 35mm cameras at 90 feet per minute. In the Roocolor camera 16mm film produces 24 frames per second at the rate of 72 feet per minute. For example: 900 feet of 35mm pictures on 720 feet of 16mm Kodachrome Safety Stock. The saving in cost and weight is considerable.

To arrive at the largest possible image on a piece of 16mm Kodachrome motion picture stock, an intermittent movement was designed with a single pullover pin so that single perforated Kodachrome could be utilized. As all professional cinematographers expect rigid registration of each image during exposure, the pin acts as a pilot pin in that it engages the film at right angles to the film travel through the gate, moving in that position the entire travel distance, disengaging at right angles at the end of travel. After the pin has centered the film at the aperture a rotor and pressure plate "stencil" the film tightly during the exposure. Up and down misalignment is prevented by side-pressure parallelograms. Because of the larger image, standard 35mm camera lenses are used.

Since the film travels through the Rotocolor camera on its side, a novel take-up was designed. Discs feed and take up the film. These ride on cones which act as clutches. The tension is automatically adjusted during the takes by the weight of the film on the cones.

A novel feature of the Rotocolor Optical Printer is the Harrison Color correcting filter wheel. Color corrections as well as density improvement can be done in printing.

The Rotocolor organization is made up of Hollywood professional cinematographers and other technicians, nearly all of them veterans back from the war. Negotiations are now under way for a local war plant to manufacture Rotocolor equipment so that it may become available to the motion picture industry in 1946.

(COURTESY INTERNATIONAL PHOTOGRAPHER)

TECHNICOLOR

The first Technicolor laboratory was built within a railway car at Boston. In 1917, this car was transported to Jacksonville, Florida, for the production of the first Technicolor feature, "The Gulf Between."

This feature had been preceded by one photographed in England by another process. This process photographed the color components by successive exposures, and it was nothing for a horse to have two tails, one red and one green, and color fringes were visible whenever there was rapid motion. Technicolor's idea was two simultaneous exposures from the same point of view—but it called for special attachments on the projector, which were found impractical.

Technicolor tried and abandoned special attachments on the projector. It abandoned additive process and turned to imbibition. It developed the two-color process to the point where it was good—but Dr. Kalmus felt that it was not good enough. Yet this process was a necessary step to present-day Technicolor.

In May, 1932, Technicolor completed the building of its first three-component camera and had one unit of its Hollywood plant equipped to handle a moderate amount of three-color printing. This three-strip process, which is now standard, has since undergone continual development and improvement.

The present-day three-component Technicolor process, which makes use of special cameras, may be described briefly as follows:

Light reflected from a photographed object enters a single lens and strikes a prism. Part of the light passes through the prism and through a green filter to a green sensitive primary negative. The remainder, reflected at right angles, is absorbed by two other primary negatives, individually sensitive to blue and red light. These negatives which have recorded the primary color aspects (red, green and blue) of the scene are developed to produce negatives which look much like black-and-white negatives, but each one is a record of the primary colors in the scene.

Thus, in photographing a red barn in a green field with a blue sky, the red record negative would have the image of the barn, the green record negative the image of the field, and the blue record negative the image of the sky.

From each of these three-color separation negatives a special positive relief image is printed and developed. These positives differ from ordinary positives in that the picture gradations are represented by varying thicknesses of hardened gelatine. These positives, which are called "matrices," are used as printing plates. They absorb suitably colored dyes and are then used in a manner similar to color plates for a lithograph, the dye image from each of the three matrices being transferred one after the other upon the final completed print ready for projection.

In addition to this well established standard three-strip procedure, Technicolor is now using its Monopack process, which does away with the necessity for special cameras.

TECHNICOLOR MONOPACK

In present methods of motion picture photography where several copies or prints are required, the film which is exposed in the camera becomes the "original" record of the scene. In either black and white or clor photography this "original" may be a negative or positive, depending upon the type of process.

Monopack is single film which can be exposed in any standard black and white camera with color-corrected lenses, developed as a negative, but is reversed in processing to become a positive color print. It has three layers of light sensitive emulsions, scarcely thicker than ordinary black and white film, but each emulsion layer sensitive to a primary color.

The surface emulsion is sensitive to blue; the second emulsion is sensitive to green and the third emulsion is sensitive to red. After development as a negative, the three images are bleached out and again exposed and developed in coupler developers. The resultant images are positive and dyed with colors complementary to the emulsion layers. All three colored images being directly super-imposed upon one another, perfect registration is assured. Critical sharpness of the three primary images and the lack of grain of this multilayered film produce extremely sharp separation results.

For additional prints from Monopack, separation negatives must be made, by an optical printer in which the Monopack is projected through a filter for each separate color after which the conventional Technicolor imibition process is employed, as in the case of other type of originals, either three-strip negative or successive-exposure cartoon color photography.

MAGNACOLOR

Magnacolor is a two-color system and is subject to limitations in its color rendition. While excellent results can be produced with the proper care, exact rendition of the many colors is impossible. However, the results—while not exactly faithful and true—are very pleasing, beautiful and acceptable to the eye.

For best results, various shades and tints of blue should be used liberally in the sets, costumes and general composition so that the warmer colors do not predominate.

Exposure is made on the regular Bipack negative film in a standard camera previously adjusted to take two films in a special pressure plate to insure good contact between the front and rear films of the Bipack and equipped with magazines of the double type for that purpose.

Outdoor exposure on exterior type negative is made using an emulsion speed rating of Weston 10, and General Electric 16.

Interiors may be photographed on the exterior type negative by using arc lights or interior type negatives with incandescent lights, the speed rating being Weston 12 and General Electric 18.

THOMASCOLOR

The Thomascolor process is quite different from other color film, in that it employs a standard black-and-white single emulsion film as well as regular black-and-white technique and developing methods, from exposure of the original negative through the processing of transparent positives. The only variance is that with a single shutter opening, three color separation negatives are exposed at once.

The process consists of a single strip of single emulsion panchromatic film 35 mm or 16 mm upon which is registered simultaneously three black-and-white images photographed through the Thomascolor filters. For photographing and projecting, an optical system is used containing filters, replacing the regular camera and projector lens. Thomascolor employs an optical system that embodies refraction, partial and total reflection to make three identical color corrected images simultaneously. A projection lens of singular ingenuity causes the light passing through the black-and-white positive to be filtered and then colored with the three colors used in the process. The projected images are superimposed in full natural color upon the screen. There are no dyes, no toning or tinting of either the positive or negative. The colors are due entirely to perfect spectral cut-off in making the negative and to projected and superimposed colored light to rected, assuring sharp focus and definition of all three images.

Since the Thomascolor has but a single aperture, and hence a single viewpoint all paralllax must obviously be eliminated. Perfect registration and identical image size are assured. The optical unit displaces the regular camera lens and creates three identical images. This unit is available in varying focal lengths and is highly color corrected, assuring sharp focus and definition of all four images.

The film is developed like any ordinary black-and-white films, and as all images are on the same strip, they are developed simultaneously. Hence all shrinkage must be equal throughout. Therefore, the three images are automatically in register as to size as well as to superimposition on the screen.

Printing the film follows the black-and-white technique the same as the negative. Ordinary black-and-white orthochromatic film is used for the positives. The same equipment and chemicals as are now emp'oyed in any good laboratory are used. Special effect and trick work are practical and easy to control due to the fact that the process is basically black-and-white and the color results from white light rather than chemicals or dyes.

The Thomascolor photographing unit is a single assembly devoid of moving parts. It takes the place of the lens in all standard motion picture and still cameras. The change-over is very simple and as quick as changing any ordinary lens. Similarly the Thomascolor projector mount, which is about the size of the average projector lens, is placed where the ordinary lens is mounted. There are no moving parts in this assembly either.

Since three color separation images take the place of a single 35mm black-andwhite frame, the same area of light is actually transmitted to the screen as shown when black-and-white pictures are shown. Superimposition of one color upon another eliminates any disposition to graininess and intensifies the brightness range of colors.

For use in the Graphic Arts four color separation negatives may be exposed at once.

INFRARED PHOTOGRAPHY

The value of photography by Infrared lies in the fact that Infra-red radiation and visible light often are reflected and transmitted quite differently by common objects. For example, chlorophyll in live green foliage absorbs a large percentage of the visible light which falls upon but does not absorb the invisible Infrared radiation. This is reflected almost entirely by the leaf structure, and therefore is recorded by means of the Infrared sensitive material. Foliage thus appears white in an Infrared photograph.

Infra-red radiation is freely transmitted through atmospheric haze, so distant scenes can be recorded with greater clarity than they can be seen with the eye. There is no fundamental difference between the practice of Infrared photography and that in which visible light is used.

Any photographer, equipped for work with panchromatic material can make Infrared photographs without additional equipment other than filters. There are, however, a few precautions which should be observed.

Infrared rays, because of their longer wave length, do not focus in the same plane as visible light rays in the case of many lenses. It is therefore necessary to make an adjustment to correct for focusing difference between Infrared and visible light rays.

Lens types vary in their Infrared focusing correction, and sharper Infrared pictures are obtained if the lens is extended about one-quarter per cent of its focal length after it has been focused for visible light. Some lenses will give satisfactory focus for the near-infrared by focusing through a 25A filter. The exposure for average bright sunlight scenes with a 25A or 29F filter is about 1/25 second at F.8 or equivalent. When an 87 filter is used, double the exposure. Of course, the test method is best.

In Infrared scenes with filters, the sky is rendered almost black, clouds and snow are white, shadows are very dense and lack detail, grass and leaves appear very light, distant details are clear and sharp and when printed darker, appear like night shots. In fact many night shots are made that way.

While Infrared aerial photography is primarily useful in obtaining extreme haze penetration and high contrast, there are other distinct advantages in such photography. For example, bodies of water are rendered very dark in sharp contrast to land and field and woods are rendered very light. Cities are rendered darker than fields. For this reason, in very high altitude Infrared pictures cities appear as dark patches surrounded by lighter country.

Infrared is not recommended for close shots of faces, as the flesh tends to appear translucent, red lips come out as white and eyes appear very dark producing a very weird effect.

To obtain Infrared effect a filter must be used. The Wratten A (No. 25) is recommended. Other Wratten filters can also be used, such as the Nos. 29 or 70, which require the same exposure as the No. 25. The No. 88, 89, or 89a which require about 1.5 times the exposure; and the No. 87 or 88a which require double the exposure.

DAYLIGHT EXPOSURES

Open landscapes, Summer sunlight, Close-ups, Bright Sunlight.			
With Filter A, G, F, or No. 70	With Filter No. 88, 89, or 89a 1/25 sec. at F.8	With Filter No. 87 or 88a 1/25 sec. at F.5.6	Without Filter for Ordinary (Blue sensitive) Rendering. 1/100 sec. at F.11

PHOTOFLOOD EXPOSURES

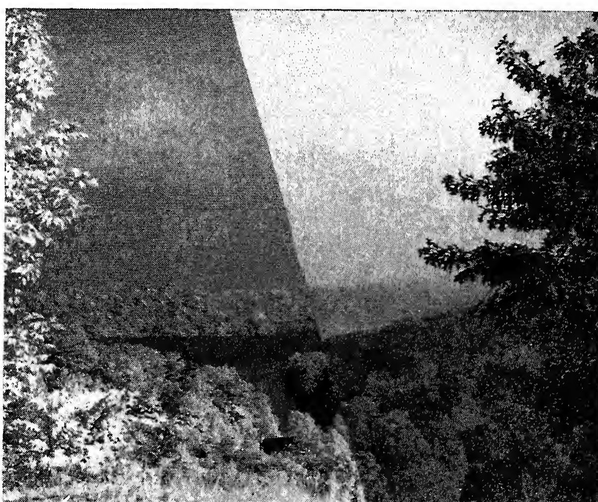
With Wratten A, G, or F, Filter and for 2 No. 1 Photoflood Lamps, dark colored objects. For light colored subjects, use one stop smaller.

Lamp Distance	Lamps in Kodaflectors	Lamps in Kodak Handy Reflectors
3 Feet	F.11 ½ sec.	F.8 ½ sec.
5 Feet	F.8 ½ sec.	F.5.6 ½ sec.

Blackout Flash Pictures

This technique permits flash photography in almost complete darkness without the usual flash of ordinary bulbs. The only thing visible is a dull red glow from the lamp itself. Designed for use with Infrared film only, such photography has application to news work, military and experimental practice. The principle of blackout flash photography is that the scene is illuminated only by Infrared radiation and photographed on Infrared film. The radiation comes from the flash bulb which is coated with an Infrared transmitting lacquer like the No. 89a filter. No visible light reaches the scene; in the fact the only thing visible is a slight red glow from the lamp. No filter is needed over the lens as the flash bulb fulfills that function. The following exposures are given as a guide only and apply to normal conditions.

1/50 sec. at F.5.6 for distance of 10 feet
1/50 sec. at F.4.5 for distance of 15 feet
1/50 sec. at F.4 for distance of 20 feet



Comparison of ordinary and Infra-red photography to show haze penetration. Left-hand segment taken by Infra-red.

(COURTESY EASTMAN KODAK CO.)

FILTERS

Their Use and Effect with Sunlight Exposure on Panchromatic Films

AERO 1 **Light Yellow**	Slight color correction for all types of panchromatic films. Produces slight contrast. Penetrates light haze. Helps to snap up faces with very little added exposure.
AERO 2 **Yellow**	Normal color correction for all types of panchromatic films; produces medium contrast; darkens blue sky; brings out clouds; greater haze penetration than AERO 1; most popular filter for general exterior photography; absorbs ultraviolet, violet and some blue.
12 Minus Blue **Yellow**	For slightly stronger effect than AERO 2; useful for the elimination of haze in aerial cinematography; color correction between AERO 2 and 15 G.
15 G **Deep Yellow**	Full color correction for all types of panchromatic films; produces greater contrast than No. 12 and AERO 2; used more for open landscape; darkens blue sky bringing out clouds; penetrates distance haze; for use with long focus lenses; lightens all yellows, reds and orange.
No. 21 **Orange**	Light over correction for all types of panchromatic films; produces more contrast than the G filter; strong clouds effects; lightens normal panchromatic make-up; good for mountain and aerial work; penetrates distance haze with long focus lenses.
23 A **Orange Red**	Medium over correction for all types of panchromatic films; darkens blue sky and water for light night effects in sunlight; lightens normal panchromatic make-up; produces more contrast than No. 21 filter; darkens greens slightly; lightens all yellow, orange, and red colors.
25 A **Red**	Great over correction on panchromatic film; action same as 23 A but more pronounced; produces very strong contrast; penetrates aerial haze; creates dramatic and spectacular night effects; standard tri-color red filter for three color separation negatives; normally used for infra-red films; special make-up required if faces are photographed.
29 F **Deep Red**	Extreme over correction and extreme contrast; full night effects in strong sunlight; turns blue sky and water to strong black; necessitates very special face make-up; turns all yellow, orange, red colors as white; used with Infra-red films; this filter is also useful with the C4 (No. 49)

and the N (No. 61) in making separation negatives from Kodachrome originals.

35 D Magenta	A contrast filter which is moderately stable; transmitting both red and blue; darkens green and orange; lightens violet and red; used singly or in pairs for scientific research and for photomicrography.
47 C5 Blue	Generally used with orthochromatic films to increase blue contrast; makes blue sky lighter and any emulsion color blind; also used as tri-color blue for color separation negatives on Kodachrome or other three color work.
49 C4 Dark Blue	Experimental tri-color filter; generally used as a viewing filter for arc and daylight illumination; increases blue contrast on all orthochromatic films; also used for color separation negatives from Kodachrome and other color transparencies.
X 1 Light Green	Has slight softening effect and good correction for all types of panchromatic films; can also be used with Ortho films; renders green and yellow, slightly lighter; red and blue, slightly darker; no make-up change necessary.
X 2 Green	Has medium softening effect and good correction on all types of panchromatic films; slightly stronger green contrast than X1; darkens reds and blues more.
56 B3 Green	Strong softening effect on all types of panchromatic films; produces green and yellow contrast; same action as X1 and X2 but with considerable stronger effect; in combination with 23A is used for soft night effects in sunlight.
58 B2 Dark Green	Slightly stronger than B3; used for more contrast; records green and yellow as light; other colors as dark; also used as tri-color green for camera three color separation work.
3 N 5 Yellow Green	Combination of AERO 1 and 50% Neutral Density; light color correction; generally used for open landscape, street, scenes, desert and snow scenes.
5 N 5 Yellow Green	Combination of AERO 2 and 50% Neutral Density; normal color correction; used for snow scenes and strong contrast; gives pleasing value on open water shots.
70 Deep Red	Extreme over correction and extreme contrast in all blue and green colors; used generally for haze cutting in aerial work and heavy night effects in strong sunlight; requires special make-up; Also used with Infra-red film.
72 Brown Red	Extreme over correction and extreme contrast in all blue values; turns blue sky and water to jet black; can be used for long distance haze

cutting in aerial work; for extreme night effects in strong sunlight; requires slight change in make-up if faces are shown.

88 A **Very Deep Red**	Cut out all visible colors but transmits Infra-red rays; can only be used with Infra-red film; used in aerial work requiring very strong sunlight; cannot be used with any other type of film.
90 **Deep Yellow**	A monochromatic viewing filter showing relative color values and their photographic densities; designed primarily for visual use to reduce color differences to the monotone; also used as a guide to determine relative density of tungsten illumination on subject.
25% ND **Neutral**	Light contrast neutralizer; soften light glare and contrast; light exposure compensator; has no corrective color value; see foot note.
50% ND **Neutral**	Medium contrast neutralizer; medium softening of glare and contrast; medium exposure compensator; may be used with all types of film and in combination with any filter; see foot note.
75% ND **Neutral**	Strong contrast neutralizer; same action as 50% ND but greater degree of softening effect; see foot note.
100% ND **Neutral**	Extreme contrast neutralizer; same action as 75% ND but with greater degree of softening effect; see foot note.
200% ND **Neutral**	Extreme contrast neutralizer; same action as 100% ND but with still greater degree of softening effect; requires very strong sunlight; see foot note.
POLA SCREEN	For controlling strong glare and brightness of sky and water; harshly lit and contrasty subjects; dissolving reflections through glass and water without changing the color density; a blue sky can be darkened to about the same extent as an A filter; may be used in combination with any filter; the maximum results are obtained with the sun's rays at 90 degrees angle to the camera; two POLA SCREENS together form a variable neutral density filter, the variable range being up to 32% transmission.

Foot Note: Neutral Density filters are neutral in their action on all colors; they provide a means of reducing the light transmission through the lens, necessitating the opening of the diaphragm which naturally produce a softening effect similar in action to neutralizing contrast.

NOTES ON THE USE AND CARE OF FILTERS

Filters are used in photography for many different and specific reasons.

CORRECTION filters are used to alter the response of the film, so that all colors will be recorded at the brightness values seen by the eye.

CONTRAST filters are used to over-emphasize or distort the brightness values, so that colors having the same brightness to the eye will asume a different brightnes in the picture.

DIFFUSION filters are used to soften sharpness of image, especially on very large close-ups, creating a soft pictorial quality.

FOG filters are used to create an illusion of fog by producing a misty or atmospheric haze appearance to subject similar to fog effect.

HAZE filters are used to reduce or eliminate atmospheric haze either when photographing on the ground or up in a plane for aerial photography.

NEUTRAL DENSITY filters are used for reducing exposure, thereby creating a softening effect on harsh lit subjects or scenes with strong glare.

TRI-COLOR filters are used for making tri-color separation negatives in color printing work from Kodachrome or other color processes.

EXPERIMENTAL filters are used for scientific research, experimental and photomicrographic photography.

MONOCHROMATIC filters are used for viewing purposes only, to distinguish between red and green and their relative luminosity, thereby assisting in the selection of the proper filter to be used.

Gelatin filters are extremely fragile and must be handled with utmost care; they should be kept flat and perfectly dry when not in use and away from heat or direct sunlight as much as possible.

Glass cemented filters should be treated with the same care and handling as a fine lens. Never wash them with water when dirty. If cleaning is necessary, use a soft cloth moistened with lens cleaning fluid, which should not be permitted to contact the cemented edges; or a bit of denatured alcohol with soft tissue, rubbing the surface very gently. Polish carefully with lens tissue. Protect them from heat and dampness which may caue the gelatin between the glasses to swell and separate.

FILTER COMPARISON TABLE

Showing Effect of Filters with Daylight Exposure on Various Colors Using Panchromatic Film

FILTER USED	COLOR PHOTOGRAPHED			
	YELLOW	RED	GREEN	BLUE
Aero 1	Slightly Lighter	Slightly Lighter	Slightly Lighter	Slightly Darker
Aero 2	Lighter	Lighter	Lighter	Much Darker
12	Very Light	Light	Lighter	Much Darker
G	Very Light	Light	Lighter	Very Much Darker
21	Very Light	Very Light	Very Slightly Darker	Very Dark
23 A	Much Lighter	Very Light	Much Darker	Very Dark
25 A	Very Light	White	Very Dark	Very, Very Dark
29 F	Very, Very Light	White	Black	Black
70	White	White	Black	Black
72	Very Light	Very Light	Very Dark	Black
88	White	White	Black	Black
3 N 5	Slightly Lighter	Slightly Darker	Slightly Lighter	Slightly Darker
5 N 5	Slightly Lighter	Slightly Darker	Slightly Lighter	Much Darker
X 1	Slightly Lighter	Dark	Much Lighter	Darker
X 2	Slightly Lighter	Dark	Very Much Lighter	Darker
56-B3	Much Lighter	Very Dark	White	Very Dark
58-B2	Much Lighter	Very Dark	White	Very Dark
47-C5	Very Dark	Black	Light	White
Neutral Density	No Color Change	No Color Change	No Color Change	No Color Change

This chart is intended to serve only as a general guide. Unusual conditions—range of shades of the various colors photographed, together with the variation of the color sensitivity of the different films used, prevents this chart from being accurate.

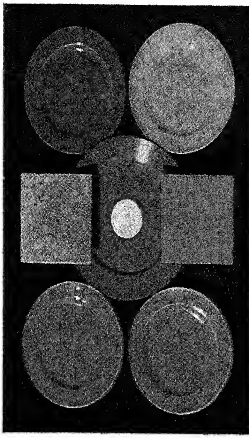
FILTERS FOR USE IN COPY WORK AND MOTION PICTURE INSERTS

To secure the greatest contrast between subject and background, panchromatic film and the proper filter must be used. The table below gives the effects of various filters on many colors in their degree of contrast with sunlight exposure.

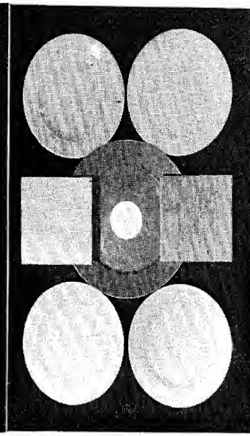
Color of Subject	To Make Lighter	To Make Darker
Red	15–21–23A–25A–29F	X1–X2–56B–58B–47 C5
Magenta	35D–23A–25A–29F	56B–47 C5
Blue	47 C5	15G–21–23A–25A–29F
Blue Green	47 C5–X2–56B	23A–25A–29F
Green	X1–X2–56B–58B–15G	25A–29F
Yellow	15G–21–23A–25A–58B	47 C5
Orange	15G–21–23A–25A	47 C5
Purple	47 C5–35D	56B
Pink	35D–23A–29F	56B–47 C5

Note: It is not possible to add to these effects by using two filters together. For instance—red and blue objects cannot both be made light by using 23A and 47 C5 filters together, for if they were combined, the 23A absorbing all colors but red, would stop blue light, while the 47 C5 absorbing all but blue, would stop the red. The result is that practically no light would be transmitted.

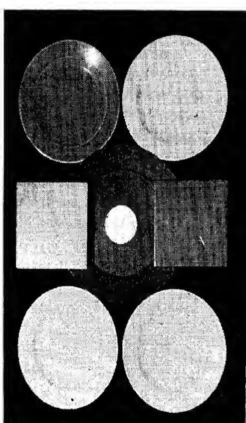
COLOR RENDERING WITH VARIOUS FILTERS



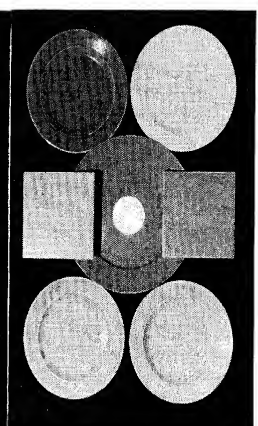
Four Color Reproduction
from Ansco Color Film



No Filter

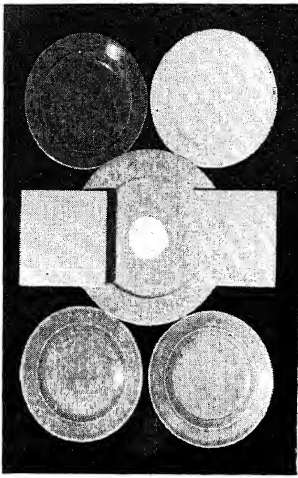


XI Filter
Light Green

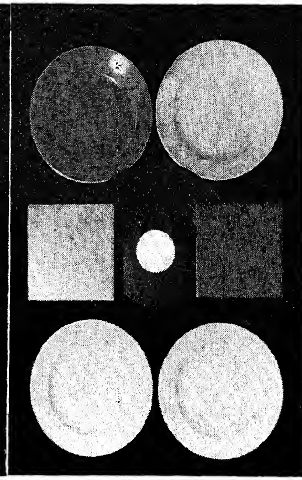


G Filter
Deep Yellow

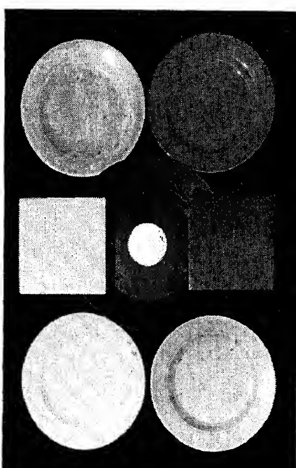
Ansco Supreme inSunlight Exposure



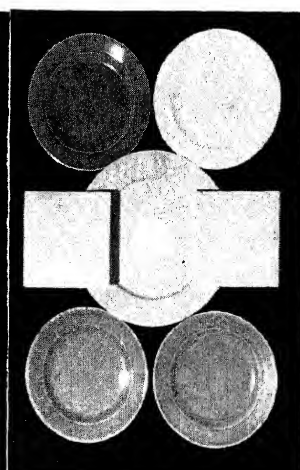
25A Filter
Red



56 B3 Filter
GREEN

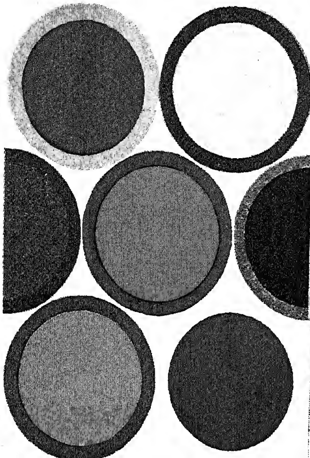


47 C5 Blue

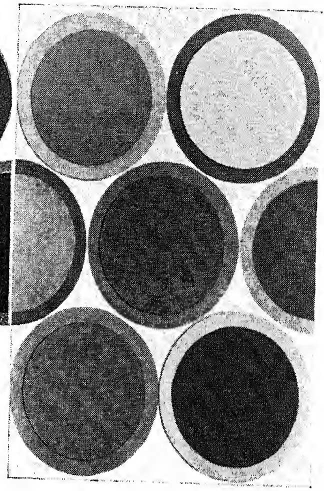


29F Filter
Deep Red

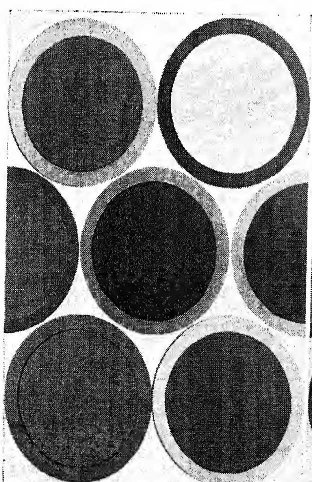
COLOR RENDERING WITH VARIOUS FILTERS



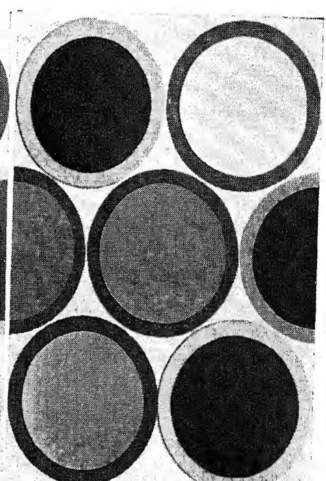
Four Color Reproduction
from Original



No Filter

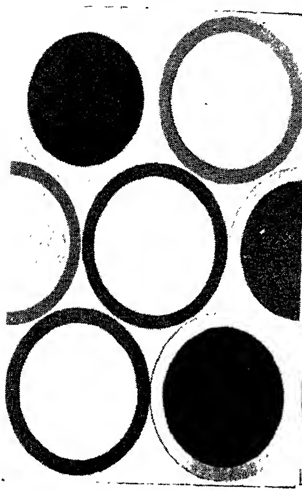


XI Filter
Light Green

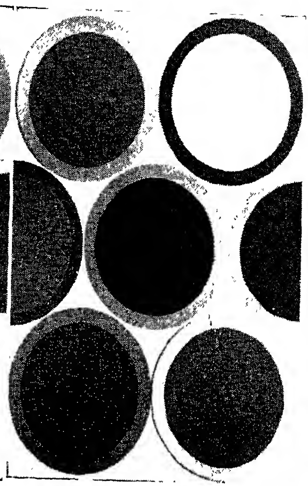


G Filter
Deep Yellow

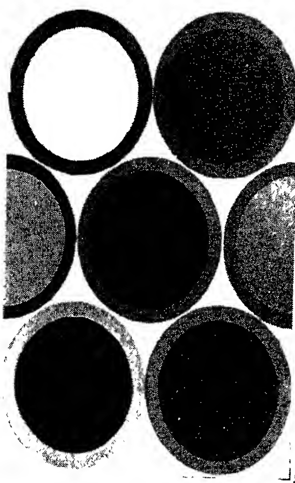
Dupont Superior 2 in Sunlight Exposure



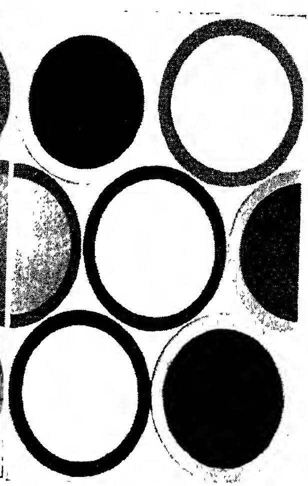
25A Filter
Red



56 B3 Filter
Green

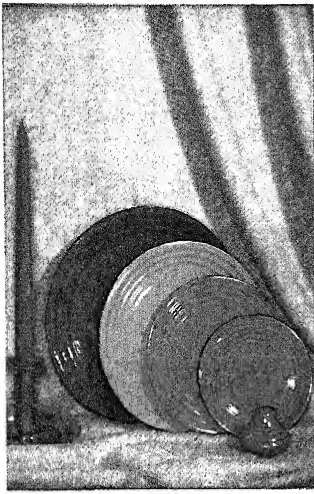


47 C5 Filter
Blue

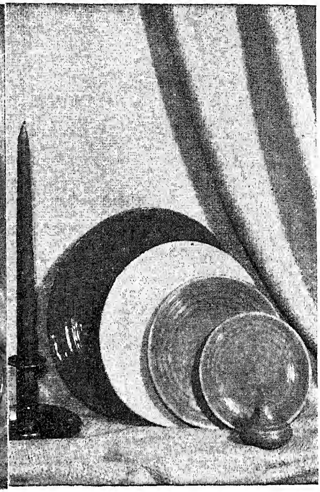


29F Filter
Deep Red

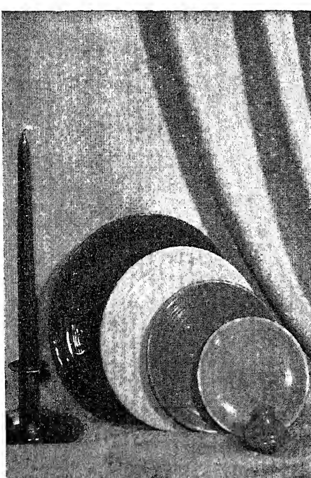
COLOR RENDERING WITH VARIOUS FILTERS



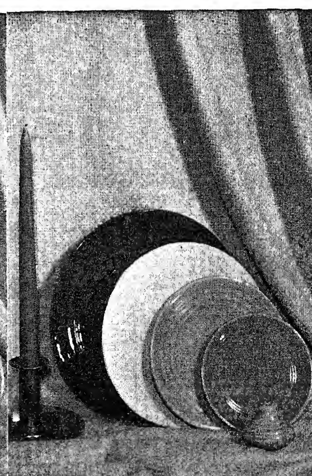
Four-Color Reproduction from Kodachrome



No Filter
Exposure, 1 Second at *f*/16

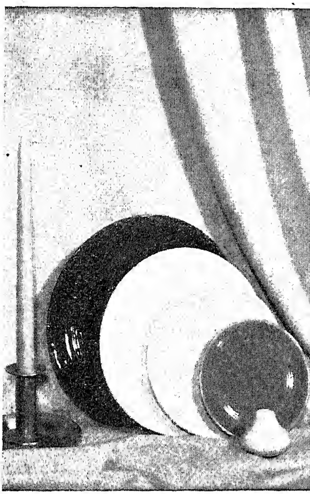


X1 Filter (Light Green)
Exposure, 3 Seconds at *f*/16

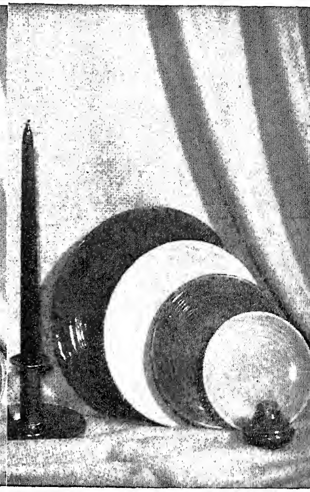


G Filter (Deep Yellow)
Exposure, 2 Seconds at *f*/16

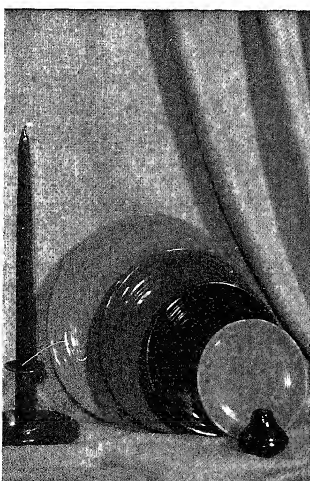
Eastman Portrait Panchromatic Film, Photoflood Illumination
Similar rendering is obtained with all Type B Panchromatic Materials



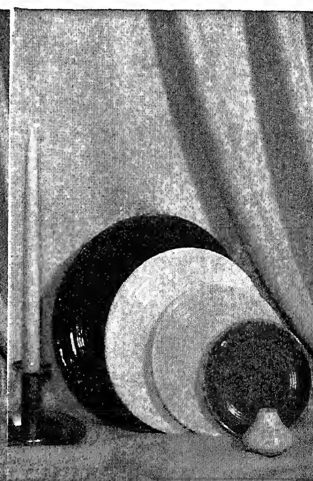
A Filter (Tricolor Red)
Exposure, 4 Seconds at *f*/16



B Filter (Tricolor Green)
Exposure, 6 Seconds at *f*/16



C5 Filter (Tricolor Blue)
Exposure, 10 Seconds at *f*/16



F Filter (Deep Red)
Exposure, 8 Seconds at *f*/16

EFFECT FILTERS AND THEIR USE

FOG FILTERS

For Creating and Producing Various Fog Effects

HARRISON & HARRISON

No. 1	Very slight misty effect
No. 2	Light hazy atmosphere
No. 3	Medium fog effect with soft highlight halo
No. 4	Strong fog effect with medium highlight halo
No. 5	Dense fog effect with strong highlight halo
No. 6	Graduated from No. 1 to No. 4

GEO. H. SCHEIBE

No. ⅛, ¼	Atmospheric hazy mist
No. ½	Very light fog effect
No. 1	Light fog effect, misty appearance
No. 2	Medium fog effect
No. 3	Heavy fog effect
No. 4	Dense and ghostly fog effect
No. 5	Graduated, from light to dense

VIEWING FILTERS

For Visual Use in Calculating Color Values

EASTMAN KODAK CO. GEO. H. SCHEIBE HARRISON & HARRISON

No. 90	For pan film with Mazda lights
No. 56 50N.D.	For pan film with arc or daylight
No. 49C	For ortho film with arc or daylight
Purple	For two or three color processes

GRADUATING FILTERS

For Producing Various Cloud and Sky Effects

GEO. H. SCHEIBE HARRISON & HARRISON

Aero 2	Aerial haze and light cloud effects
15G	General cloud and sky filter
23A	Light nite effect and sky overcorrection
25A	Medium nite effect and heavy overcorrection
29F	Strong nite effect with bright sunlight

DIFFUSION FILTERS

For Creating Various Degrees of Diffusion and Softness

EASTMAN KODAK CO.

O. A.	Very light diffusion for distance scenes
O. B.	Light soft diffusion for medium figures
M. P. ¼	Moderate diffusion with delicate softness
M. P. ½	Medium diffusion for pictorial quality
M. P. A.	Strong diffusion for large close-ups
M. P. B.	Severe diffusion and strong flare

MITCHELL CAMERA CO.

Filter A	Slight diffusion for long shots
Filter B	Medium diffusion for medium size figure
Filter C	Strong diffusion with general softness
Filter D	Harsh diffusion for large close-ups
Variable	From Filter A to Filter D

LAMINATED GLASS DIFFUSIONS

Series D

HARRISON & HARRISON

No. 1	Extremely light for distance shots
No. 2	Moderately soft for slight diffusion
No. 3	Medium diffusion for pictorial softness
No. 4	Strong diffusion with slight haliation
No. 5	Heavy diffusion for large close-ups
No. 6	Extreme diffusion with fuzzy softness

GEO. H. SCHEIBE

No. 1/256-1/128	Extremely mild for wide angle lenses
No. 1/64-1/32	Delicate diffusion with softness
No. 1/16-1/8	Light diffusion for distant scenes
No. 1/4-1/2	For medium set-ups of two figures
No. 1	Strong diffusion for close figures
No. 2	Heavy diffusion with slight flare
No. 3	Extreme diffusion with strong flare

Under normal conditions, Effect Filters do not require additional exposure.

FILTER FACTORS

ANSCO FILMS

TO SUNLIGHT

FILTER	Ultra-Speed	Supreme	Minipan	Color of Filter
AERO 1..........	1.5	1.5		Light Yellow
AERO 2..........	2	2		Yellow
3N5..............	4	4		Yellow Green
5N5..............	6	6		Yellow Green
X1...............	4	4	9	Light Green
X2...............	6	6	14	Green
12................	2	2		Yellow
15G..............	2	2	6	Deep Yellow
21................	2	2		Orange
23A..............	4	4	5	Light Red
25A..............	6	6	16	Red
29F..............	8	8		Deep Red
47-C5............	16	16	16	Blue
49-C4............	64	64		Deep Blue
56-B3............	4	4		Green
58-B2............	12	12	24	Green
70................	Used with infra-red film			Deep Red
72................	*15	*15		Brown Red
25% N.D..........	1.8	1.8	1.8	Neutral
50% N.D..........	3.0	3.0	3.0	Neutral
75% N.D..........	6.0	6.0	6.0	Neutral
100% N.D.........	10.0	10.0	10.0	Neutral
Pola Screen.......	4.0	4.0	4.0	Gray

*For night effects in sunlight

FILTER FACTORS

DUPONT FILMS

TO SUNLIGHT

FILTER	Superior 1 Type 104	Superior 2 Type 126	Superior 3 Type 127	Infra-D Type 105	Safety Panchro Type 301	Safety Panchro Type 314	Color of Filter
Aero 1....	2.0	1.5	1.5		1.5	2.0	Light yellow
Aero 2.....	2.5	2.0	2.0		2.0	2.5	Yellow
3 N 5......	4.0	4.0	6.3		4.0	4.0	Yellow green
5 N 5......	6.3	5.5	8.0		5.5	6.3	Yellow green
X 1........	4.5	4.0	4.0		4.0	4.0	Light green
X 2........	5.6	5.6	5.0		5.0	5.0	Green
12........	2.5	2.0	2.0		2.0	2.5	Yellow
15G.......	3.2	2.5	2.5		2.5	3.2	Deep yellow
21.........	3.2	2.5	2.5		2.5	4.0	Orange
23A........	5.0	4.0	3.2		4.0	5.5	Light red
25A........	10.0	5.0	3.2	16.0	5.0	8.0	Red
29 F......	16.0	10.0	5.0	16.0	10.0	12.0	Deep red
47-C 5.....	6.3	6.3	6.3		6.3	6.3	Blue
49-C 4.....	16.0	16.0	16.0		16.0	16.0	Deep blue
56-B 3.....	3.5	3.0	3.2		3.0	3.5	Green
58-B 2.....	6.3	6.3	6.3		6.3	6.3	Green
70.........				32.0			Deep red
72.........	Not recommended						Brown red
25% N.D...	1.8	1.8	1.8	1.8	1.8	1.8	Neutral
50% N.D...	3.2	3.2	3.2	3.2	3.2	3.2	Neutral
75% N.D...	5.6	5.6	5.6	5.6	5.6	5.6	Neutral
100% N.D...	10.0	10.0	10.0	10.0	10.0	10.0	Neutral
Pola Screen	4.0	4.0	4.0	4.0	4.0	4.0	Gray

FILTER FACTORS

EASTMAN FILMS

TO SUNLIGHT

FILTER	Super XX Type 1232	Plus X Type 1231	Back-gr'nd X Type 1230	Back-grn'd Type 1213	Pana-tomic Type	Infra-Red Type 1210	Color of Filter
Aero 1....	1.5	1.5	1.5	1.5	1.5		Light yellow
Aero 2.. .	2.	2	2	2.	2.		Yellow
3N5......	4	4.	4.	4.	4.		Yellow green
5 N 5.. ..	5.	5.	5.	5.	5.		Yellow green
X 1........	4.	4.	4.	4.	4.		Light green
X 2..... .	Not recommended for daylight						Green
12........	2 5	2.5	2.5	2.5	2.5		Yellow
15 (G.). .	3.	3.	3.	3.	3.		Deep yellow
21.. ..	3 5	3 5	3.5	3.5	3.5		Orange
23 A	4.	4	4.	4.	4.		Light red
25 (A.) . .	7	7.	7.	7.	7.		Red
29 F...	15.	15.	15	15.	15.	15.	Deep red
47-(C 5) .	5.	5.	5.	5.	5.		Blue
49-(C 4)	12.	12.	12	12.	12.		Deep blue
56-(B 3) ..	5	5.	5.	5.	5.		Green
58-(B 2) ..	6	6.	6.	6.	6.		Green
70.... . .	150.	150.	150.	150.	150.		Deep red
72..	80.	80.	80.	80	80.		Brown red
25% N.D...	1.8	1 8	1.8	1.8	1.8	1.8	Neutral
50% N.D...	3.1	3.1	3.1	3 1	3 1	3 1	Neutral
75% N.D...	5.6	5 6	5.6	5.6	5 6	5 6	Neutral
100% N.D...	10.	10.	10.	10.	10.	10.	Neutral
Pola Screen Type I.....	4.	4.	4.	4.	4.	4.	Gray

FILTER FACTORS

COMPUTED INTO LENS STOPS

Showing Amount of Stops to Open Diaphragm for Various Filter Factor Numbers

Factor Numbers	Stops Open From Normal	Factor Numbers	Stops Open From Normal
1	0	10	3¼
1.5	½	12	3½
2	1	14	3¾
2.5	1¼	16	4
3	1½	20	4¼
3.5	1¾	24	4½
4	2	28	4¾
4.5	2⅛	32	5
5	2¼	40	5¼
6	2½	48	5½
7	2¾	56	5¾
8	3	64	6

EXAMPLE:
Light value is F.16 without Filter.
Filter wanted is 23A—which has a factor of 4†
Factor 4 shows 2 stops open from normal (without Filter.) 2 stops‡ open from F.16=F.8.

F.16	F.11	F.8	F.5.6	F.4	F.2.8
Light Value	1 Stop Open	2 Stops Open	3 Stops Open	4 Stops Open	5 Stops Open

CORRECT ANSWER: F.8

†See Page 74 for Filter Factors.
‡See Page 89 for all Lens Stops.

FILTER FACTOR COMPENSATOR

DIAPHRAGM EXPOSURE WITH FILTERS OF VARIOUS FACTORS

FACTOR NUMBERS

Exposure Without Filter	1.5	2	2.5	3	4	5	6	8	10	12	14	16	18	20	22	24
F.2.3	F.2.															
2.8	2.3	2.						Exposure With Filter.								
3.2	2.8	2.3	2.2	2.												
4.	3.2	2.8	2.5	2.3	2.											
4.5	4.	3.2	3.	2.8	2.3	2.2	2.									
5.6	4.5	4.	3.6	3.2	2.8	2.5	2.3	2.								
6.3	5.6	4.5	4.3	4.	3.2	3.	2.8	2.3	2.2	2.						
8.	6.3	5.6	4.5	4.5	4.	3.6	3.2	2.8	2.5	2.3	2.2	2				
9.1	8.	6.3	5.9	5.6	4.5	4.3	4.	3.2	3.	2.8	2.5	2.3	2.2	2.		
11.3	9.1	8.	7.2	6.3	5.6	5.1	4.5	4.	3.6	3.2	3.	2.8	2.5	2.3	2.2	2.
12.5	11.3	9.1	8.5	8.	6.3	5.9	5.6	4.5	4.3	4.	3.5	3.2	3.	2.8	2.5	2.3
16.	12.5	11.3	10.1	9.1	8.	7.2	6.3	5.6	5.1	4.5	4.3	4	3.6	3.2	3.	2.8
18.	16.	12.5	11.8	11.3	9.1	8.5	8.	6.3	5.9	5.6	5.1	4.5	4.3	4.	3.5	3.2
22.	18.	16.	14.	12.5	11.3	10.1	9.1	8.	7.2	6.3	5.9	5.6	5.1	4.5	4.3	4.
25.	22.	18.	17.	16.	12.5	11.8	11.3	9.1	8.5	8.	7.2	6 3	5.9	5.6	5.1	4.5
32.	25.	22.	20.	18.	16.	14.	12.5	11.3	10.1	9.1	8.5	8.	7.2	6.3	5.9	5.6

CAMERA SPEED NORMAL—SHUTTER OPENING CONSTANT

LENS SIZE CONVERSION

Millimeters into Inches

MM.	IN.	MM.	IN.	MM.	IN.	MM.	IN.
12½=	1/2	105=	4 1/5	215=	8 3/5	325=	13
15=	3/5	110=	4 2/5	220=	8 4/5	330=	13 1/5
20=	4/5	115=	4 3/5	225=	9	335=	13 2/5
25=	1	120=	4 4/5	230=	9 1/5	340=	13 3/5
28=	1 1/8	125=	5	235=	9 2/5	345=	13 4/5
30=	1 1/5	130=	5 1/5	240=	9 3/5	350=	14
32=	1 1/4	135=	5 2/5	245=	9 4/5	355=	14 1/5
35=	1 2/5	140=	5 3/5	250=	10	360=	14 2/5
38=	1 1/2	145=	5 4/5	255=	10 1/5	365=	14 3/5
40=	1 5/8	150=	6	260=	10 2/5	370=	14 4/5
45=	1 4/5	155=	6 1/5	265=	10 3/5	375=	15
50=	2	160=	6 2/5	270=	10 4/5	385=	15 2/5
55=	2 1/5	165=	6 3/5	275=	11	400=	16
60=	2 2/5	170=	6 4/5	280=	11 1/5	415=	16 3/5
65=	2 3/5	175=	7	285=	11 2/5	425=	17
70=	2 4/5	180=	7 1/5	290=	11 3/5	435=	17 2/5
75=	3	185=	7 2/5	295=	11 4/5	450=	18
80=	3 1/5	190=	7 3/5	300=	12	465=	18 3/5
85=	3 2/5	195=	7 4/5	305=	12 1/5	475=	19
90—	3 3/5	200=	8	310=	12 2/5	485=	19 2/5
95=	3 4/5	205=	8 1/5	315=	12 3/5	495=	19 4/5
100=	4	210=	8 2/5	320=	12 4/5	500=	20

NOTE:—The above conversion table is admitted to slight error due to the fact that 25.4 mm. equals 1 inch, but suffices for practical purposes.

LENSES

Motion Picture and Miniature Cameras
Enlarging and Projection

BELL & HOWELL

All lenses Filmocoted

Taylor Hobson

COOKE SPEED PANCHRO

25mm. F. 2
28mm. F. 2
32mm. F. 2
35mm. F. 2
40mm. F. 2
50mm. F. 2
75mm. F. 2
100mm. F. 2.5

COOKE TELE-PHOTO

8½ in. F. 5.6
11 in. F. 5.6
12½ in. F. 5.6
15 in. F. 5.6
20 in. F. 5.6

BELL & HOWELL EYEMAX

50mm. F. 2.8
6 in. F. 4.5

COOKE VARO ZOOM LENSES

40mm. to 120mm.
F. 3.5 to F. 5.6

FOR 16mm. Cameras

1 in. F. 1.5
1 in. F. 2.5
2 in. F. 3.5
3 in. F. 4
4 in. F. 4.5
6 in. F. 4.5
6 in. F. 5.5

FOR 8mm. Cameras

12½mm. F. 1.4
12½mm. F. 1.9
12½mm. F. 2.5
1 in. F. 1.5
1½ in. F. 3.5
2 in. F. 3.5

Bell & Howell Continued

PROJECTION LENSES

35mm. Projectors

3½ in. F. 4.5
5 in. F. 3.5

16mm. Projectors

15mm. F. 2.1
¾ in. F. 3
1 in. F. 2.46
1½ in. F. 1.9
2 in. F. 1.6
2½ in. F. 1.65
3 in. F. 2
4 in. F. 2.5

8mm. Projectors

¾ in. F. 1.8
1 in. F. 1.6
1½ in. F. 2.1

ELGEET LENSES

16mm. Cameras

1 in. F. 3.5
50mm. F. 3.5
105mm. F. 4.5

8mm. Cameras

½ in. F. 1.5
½ in. F. 1.9
½ in. F. 2.5
½ in. F. 3.5
38mm. F. 2.5
38mm. F. 3.5

Enlarging Lenses

50mm. F. 4.5
90mm. F. 4.5
105mm. F. 4.5
127mm. F. 5.6
165mm. F. 4.5

ASTRO LENSES

25mm. F. 1.8
35mm. F. 1.8
40mm. F. 1.8
50mm. F. 1.8
75mm. F. 1.8
100mm. F. 1.8
35mm. F. 2.3
40mm. F. 2.3
50mm. F. 2.3
75mm. F. 2.3
100mm. F. 2.3
125mm. F. 2.3
150mm. F. 2.3
200mm. F. 2.3

DALLMEYER LENSES

SUPER Six

15mm. F. 1.5
25mm. F. 1.5
25mm. F. 1.9
31mm. F. 1.9
38mm. F. 1.9
42mm. F. 1.9
50mm. F. 1.9
57mm. F. 1.9
63mm. F. 1.9
75mm. F. 1.9
100mm. F. 1.9
150mm. F. 1.9

Pentac

1 in. F. 1.5
1½ in. F. 2.9
2 in. F. 2.9
2½ in. F. 2.9
3 in. F. 2.9
4 in. F. 2.9
5 in. F. 2.9
6 in. F. 2.9

Speed Anastigmat

20mm. F. 1.5
1 in. F. 1.5
2 in. F. 1.5
3 in. F. 1.5

LENSES

Motion Picture and Miniature Cameras
Enlarging and Projection

BAUSCH & LOMB LENSES

BALTAR

25mm. F. 2.3
30mm. F. 2.3
35mm. F. 2.3
40mm. F. 2.3
50mm. F. 2.3
75mm. F. 2.3
100mm. F. 2.3
152mm. F. 2.7

TESSAR

3⅝ in. F. 4.5
4⅜ in. F. 4.5
5¼ in. F. 4.5
6 7/16 in. F. 4.5
7½ in. F. 4.5
8¼ in. F. 4.5
10 in. F. 4.5
12 in. F. 4.5

ENLARGING TESSAR

3⅝ in. F. 4.5
4⅜ in. F. 4.5

PROJECTION
Super Cinephor
Balcoated

2 in. F. 2
2¼ in. F. 2
2½ in. F. 2
2¾ in. F. 2
3 in. F. 2
3¼ in. F. 2
3½ in. F. 2
3¾ in. F. 2
4 in. F. 2
4¼ in. F .2
4½ in. F. 2
4¾ in. F. 2
5 in. F. 2

Cinephor
Series 1

3 in.
3¼ in.
3½ in. F. 2.9
3¾ in. to
4 in. F. 4.6
4¼ in.
4½ in.
4¾ in.
5 in.
5¼ in.
5½ in.
5¾ in.
6 in.

Bausch & Lomb Lenses—Cont.

Cinephor Series II
Balcoated

5¼ in.
5½ in.
5¾ in.
6 in.
6¼ in.
6½ in.
6¾ in.
7 in.
8 in.
8½ in.
9 in.

Cinephor

3½ in. F. 2
3¾ in. F. 2
4 in. F. 2
4¼ in. F. 2
4½ in. F. 2
4¾ in. F. 2
5 in. F. 2

LEITZ LENSES

Xenon

50mm. F. 1.5

Summitar

50mm. F. 2

Elmar

35mm. F. 2
50mm. F. 3.5
90mm. F. 4

Leica

50mm. F. 3.5
90mm. F. 4.5
127mm. F. 4.5

Hektor

28mm. F. 6.3
73mm. F. 1.9
135mm. F. 4.5

Thambar

90mm. F. 2.2

GOERZ LENSES

Kino Hypar

15mm. F. 2.7
25mm. F. 2.7
40mm. F. 2.7
50mm. F. 2.7
75mm. F. 2.7
100mm. F. 2.7
40mm. F. 3
50mm. F. 3
75mm. F. 3
100mm. F. 3

KODAK LENSES

15mm. F. 2.7
1 in. F. 1.9
2 in. F. 3.5
2½ in. F. 2.7

TELE

3 in. F. 4.5
4 in. F. 2.7
4½ in. F. 4.5
5½ in. F. 4.5
6 in. F. 4.5
7½ in. F. 4.5
8½ in. F. 4.5
10 in. F. 4.5
12 in. F. 4.5

WOLLENSAK LENSES

Cine Velostigmat

½ in. F. 1.9
½ in. F. 2.5
½ in. F. 3.5
17mm. F. 2.7
1 in. F. 1.5
1 in. F. 2.5
2 in. F. 1.5

Cine Telephoto

1 in. F. 2.5

8mm. Cameras

1½ in. F. 3.5
2 in. F. 3.5
3 in. F. 4
4 in. F. 4.5
6 in. F. 4.5

Velostigmat

3½ in. F. 4.5
5 in. F. 4.5
6⅜ in. F. 4.5
7½ in. F. 4.5
8¼ in. F. 4.5
9½ in. F. 4.5
12 in. F. 4.5

Sunray Projection
for 16mm. Projectors

¾ in. F. 3
1 in. F. 2.46
1½ in. F. 1.8
2 in. F. 1.6
3 in. F. 2
3½ in. F. 2.3
4 in. F. 2.5

For 8mm. Projectors

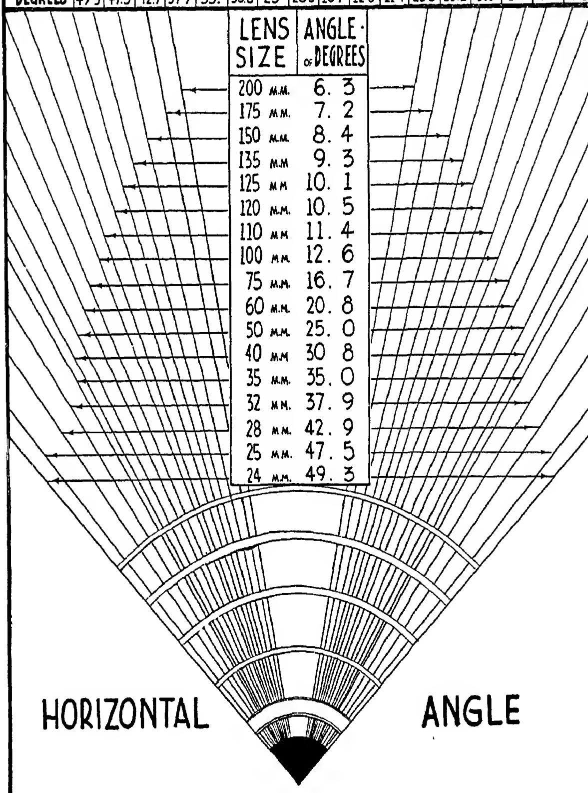
¾ in. F. 1.8
1 in. F. 1.6
1½ in. F. 2

LENS ANGLES

BY DEGREES

ANGLES OBTAINED BY VARIOUS SIZE LENSES

M.M.	24	25	28	32	35	40	50	60	75	100	110	120	125	135	150	175	200
INCHES		1	1⅛	1¼	1⅜	1⅝	2	2⅜	3	4	4⅜	4¾	5	5¼	6	7	8
DEGREES	49.3	47.5	42.9	37.9	35.	30.8	25	20.8	16.7	12.6	11.4	10.5	10.1	9.3	8.4	7.2	6.3

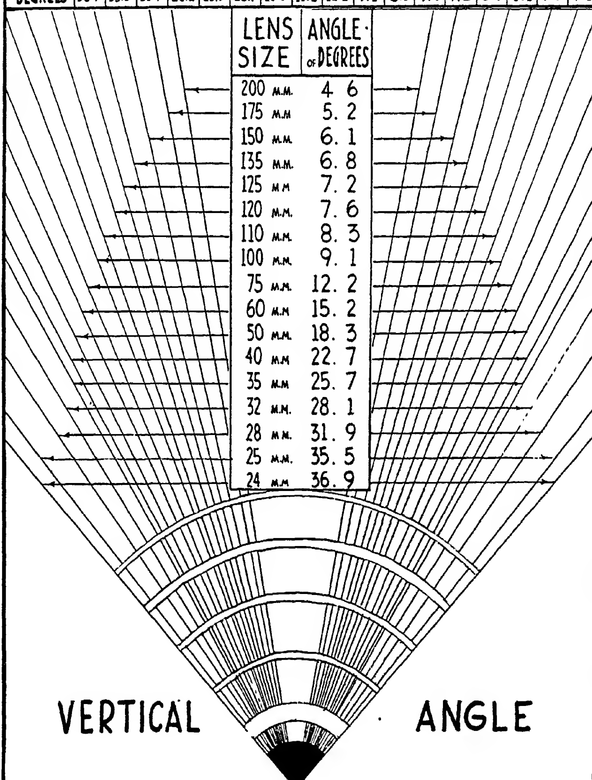


LENS ANGLES

BY DEGREES

ANGLES OBTAINED BY VARIOUS SIZE LENSES

M.M.	24	25	28	32	35	40	50	60	75	100	110	120	125	135	150	175	200
INCHES		1	1⅛	1¼	1⅜	1⅝	2	2⅜	3	4	4⅜	4¾	5	5¼	6	7	8
DEGREES	36.9	35.5	31.9	28.1	25.7	22.7	18.3	15.2	12.2	9.1	8.3	7.6	7.2	6.8	6.1	5.2	4.6



LENS SIZE	ANGLE OF DEGREES
200 M.M.	4. 6
175 M.M	5. 2
150 M.M.	6. 1
135 M.M.	6. 8
125 M.M	7. 2
120 M.M.	7. 6
110 M.M.	8. 3
100 M.M.	9. 1
75 M.M.	12. 2
60 M.M	15. 2
50 M.M.	18. 3
40 M.M	22. 7
35 M.M	25. 7
32 M.M.	28. 1
28 M.M.	31. 9
25 M.M.	35. 5
24 M.M	36. 9

LENS ANGLES

FIELD OF VIEW OBTAINED AT VARIOUS DISTANCES FROM CAMERA

35 mm. CAMERA

LENS SIZE

Distance From Lens To Subject In Feet	25 mm.				28 mm.				32 mm.			
	Height		Width		Height		Width		Height		Width	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
4	2	3	3	5	2	1	2	11	2	1	2	8
5	2	11	4	4	2	8	3	8	2	7	3	5
6	3	7	5	3	3	2	4	4	3	0	4	2
7	4	5	6	2	3	9	5	1	3	7	4	10
8	5	3	7	1	4	3	5	10	4	2	5	6
9	5	10	7	10	4	9	6	7	4	7	6	1
10	6	4	8	7	5	3	7	3	5	1	6	8
12	7	5	10	5	6	4	8	9	6	0	8	4
14	9	0	12	3	7	4	10	2	7	2	9	8
16	10	5	14	3	8	5	11	8	8	3	11	1
18	11	7	17	5	9	6	13	1	9	1	12	5
20	12	7	17	7	10	6	14	7	10	2	13	9
25	16	1	22	3	13	3	18	4	12	5	17	0
30	19	3	26	5	15	9	21	10	15	0	20	8
35	22	5	30	9	18	4	25	5	17	6	24	2
40	25	7	35	3	21	0	29	1	20	0	27	7
45	28	10	40	2	23	7	32	9	22	6	31	0
50	32	1	44	1	26	3	36	5	25	0	34	5
55	35	1	48	1	29	1	40	2	27	6	37	9
60	38	2	52	2	31	7	43	8	30	0	41	2
70	44	8	61	2	36	10	50	11	35	0	48	4
80	51	1	70	2	42	1	58	3	40	0	55	5
90	57	8	79	4	47	4	65	6	45	0	62	6
100	64	3	88	6	52	6	72	10	50	0	69	6

All Lenses slightly increase in angles when "stopped down"

LENS ANGLES

FIELD OF VIEW OBTAINED AT VARIOUS DISTANCES FROM CAMERA

35 mm. CAMERA

LENS SIZE

Distance From Lens To Subject In Feet	35 mm.				40 mm.				50 mm.			
	Height		Width		Height		Width		Height		Width	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
4	1	7	2	3	1	6	2	0	1	2	1	7
5	2	2	2	11	1	10	2	7	1	5	2	0
6	2	9	3	7	2	3	3	2	1	9	2	6
7	3	3	4	4	2	9	3	9	2	2	3	0
8	3	8	5	1	3	3	4	3	2	6	3	6
9	4	0	5	7	3	8	4	10	2	10	3	11
10	4	5	6	2	4	1	5	6	3	2	4	4
12	5	5	7	4	4	7	6	7	3	8	5	3
14	6	3	8	7	5	7	7	6	4	5	6	2
16	7	4	10	1	6	5	8	7	5	2	7	1
18	8	3	11	3	7	1	10	1	5	8	8	0
20	9	1	12	5	8	1	11	2	6	4	8	8
25	11	5	15	7	10	1	13	8	8	0	11	0
30	13	6	19	1	12	2	16	4	9	6	13	2
35	16	0	22	1	14	2	19	2	11	8	15	5
40	18	5	25	1	16	1	22	0	12	8	17	7
45	20	9	28	3	18	2	24	7	14	4	19	9
50	23	1	31	6	20	2	27	3	16	0	22	0
55	25	2	34	10	22	2	30	3	17	6	24	0
60	27	4	38	2	24	1	33	2	19	0	26	0
70	32	3	44	2	28	1	38	8	22	2	30	6
80	37	2	50	3	32	2	44	2	25	5	35	0
90	41	8	57	0	36	4	49	9	28	8	39	6
100	46	2	63	4	40	5	55	4	32	0	44	0

Based on Sound Camera Aperture Size .631 x .868

LENS ANGLES

FIELD OF VIEW OBTAINED AT VARIOUS DISTANCES FROM CAMERA

35 mm. CAMERA

LENS SIZE

Distance From Lens To Subject In Feet	60 mm.				75 mm.				100 mm.			
	Height		Width		Height		Width		Height		Width	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
4	1	0	1	5		8	1	1		7		9
5	1	3	1	9		11	1	4		9	1	0
6	1	6	2	2	1	2	1	7		11	1	3
7	1	9	2	5	1	4	1	11	1	1	1	6
8	2	0	2	8	1	7	2	3	1	3	1	9
9	2	3	3	2	1	10	2	6	1	5	1	11
10	2	6	3	7	2	1	2	9	1	7	2	2
12	3	2	4	4	2	5	3	5	1	10	2	7
14	3	8	5	3	3	0	4	1	2	3	3	1
16	4	3	5	9	3	4	4	6	2	7	3	6
18	4	8	6	6	3	8	5	2	2	10	4	0
20	5	3	7	4	4	2	5	8	3	2	4	4
25	6	7	9	2	5	3	7	3	4	0	5	6
30	8	0	11	0	6	3	8	7	4	9	6	7
35	9	3	12	9	7	3	10	1	5	6	7	8
40	10	6	14	7	8	4	11	6	6	4	8	9
45	12	0	16	5	9	5	13	0	7	2	9	10
50	13	3	18	4	10	6	14	5	8	0	11	0
55	14	9	20	2	11	6	16	0	8	9	12	0
60	16	2	22	0	12	6	17	4	9	6	13	0
70	18	3	25	6	14	9	20	3	11	1	15	3
80	21	5	29	4	17	0	23	3	12	8	17	6
90	23	6	33	2	19	0	26	1	14	4	19	9
100	26	8	37	0	21	0	29	0	16	0	22	0

Based on Sound Camera Aperture Size .631 x .868

LENS ANGLES

FIELD OF VIEW OBTAINED AT VARIOUS DISTANCES FROM CAMERA

35 mm. CAMERA

LENS SIZE

Distance From Lens To Subject In Feet	125 mm.				150 mm.				175 mm.			
	Height		Width		Height		Width		Height		Width	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In
4		7		10		6		9		5		7
5		8		11		7		9		5		7
6		9	1	2		7		10		6		9
7		11	1	3		8		11		7		10
8	1	0	1	4		9	1	2		8		11
9	1	1	1	5		11	1	3		9	1	0
10	1	2	1	7	1	0	1	4		10	1	1
12	1	5	2	1	1	2	1	7	1	0	1	5
14	1	8	2	5	1	5	2	1	1	3	1	7
16	2	0	2	8	1	7	2	4	1	5	1	9
18	2	3	3	2	1	9	2	6	1	7	1	11
20	2	6	3	4	2	1	2	9	1	11	2	3
25	3	3	4	4	2	7	3	7	2	5	2	9
30	3	8	5	3	3	3	4	5	2	11	3	4
35	4	4	6	1	3	9	5	1	3	5	3	10
40	5	0	7	0	4	3	5	9	3	10	4	4
45	5	8	7	10	4	9	6	6	4	4	4	11
50	6	4	8	8	5	4	7	4	4	10	5	6
55	6	11	9	6	5	10	8	0	5	4	6	0
60	7	6	10	4	6	4	8	8	5	10	6	7
75	8	10	12	3	7	5	10	2	6	9	7	8
80	10	3	14	2	8	6	11	8	7	8	8	8
90	11	6	15	10	9	9	13	2	8	2	9	9
100	12	9	17	7	10	8	14	8	9	8	10	11

Based on Sound Camera Aperture Size .631 x 868

LENS DIAPHRAGM SYSTEMS

AND REQUIRED EXPOSURE UNITS

Required Exposure Units	British American System	*Continental System* Heavy Type	Required Exposure Units	British American System	*Continental System* Heavy Type	Required Exposure Units	Uniform System
	F.	F.		F.	F.		U.S.
1	1		32	5.6		1	1
1½		1.2	36		6	2	2
2	1.4		40		**6.3**	4	4
2¼		1.5	44		6.5	8	8
2½		**1.6**	48		6.9	16	16
3		1.7	50		7.2	32	32
3¼		1.8	64	8		64	64
3¾		1.9	72		8.5	128	128
4	2		80		**9.1**	256	256
4½		2.2	100		10	Conversion	
5		**2.3**	128	11.3		of F. Stops	
6		2.5	144		12	to U.S. Stops	
7½		2.7	160		**12.5**	F.	U.S.
8	2.8		200		14	4 =	1
8½		2.9	256	16		4.5 =	1.4
9		3	288		17	5 =	1.6
10		**3.2**	320		**18**	5.6 =	2
11		3.3	400		20	6.3 =	2.5
12		3.5	512	22.6		8 =	4
16	4		576		24	9.1 =	6
18		4.2	640		**25**	11 =	8
20		**4.5**	1040	32		12.5 =	12
25		5	1280		**36**	16 =	16
30		5.5	2048	45		22 =	32
						32 =	64
						45 =	128

LENS STOP CALCULATOR

SHOWING ¼, ½, ¾ AND 1 STOP OPENING OR CLOSING FROM ANY SELECTED F. VALUE.

F. 1.2	F. 1.3	F. 1.4	F. 1.5
F. 1.6	F. 1.8	F. 2	F. 2.1
F. 2.3	F. 2.5	F. 2.8	F. 3
F. 3.2	F. 3.6	F. 4	F. 4.2
F. 4.5	F. 5	F. 5.6	F. 6
F. 6.3	F. 7.2	F. 8	F. 8.5
F. 9.1	F. 10	F. 11	F. 12
F. 12.5	F. 14	F. 16	F. 17
F. 18	F. 20	F. 22	F. 24
F. 25	F. 28	F. 32	F. 34
F. 36	F. 40	F. 45	F. 50

Reading down, any column, 1 full stop closed.
Reading up, any column, 1 full stop open.
Reading left to right, any row, ¼ stop closed.
Reading right to left, any row, ¼ stop open.

Example:

1 full stop closed from F.8 shows (down 1 row) F.11.
1 full stop open from F.8 shows (up 1 row) F.5.6.
¼ stop open from F.8 shows (left, 1 column) F.7.2.
¼ stop closed from F.8 shows (right, 1 column) F.8.5.
½ stop open from F.8 shows (left, 2 columns) F.6.3.
¾ stop closed from F.4.5 shows (right, 3 columns) F.6.

MAKING AMERICAN CINE LENSES

By ANDREW A. WOLLENSAK

Possibly every maker of a lens uses the same basic formula, just as a dollar watch and a hundred dollar timepiece are made to the same basic pattern. The difference lies in the degree of final perfection.

A high-grade lens starts with high quality optical glass. Squares somewhat heavier than the finished lens are kept in an oven with a sensitive temperature control until they reach the consistency of putty. They are then molded hydraulically into the desired shape at temperatures from 500° to 1500° F., depending on the type of glass. The discs are then allowed to cool gradually, for 36 to 48 hours in the annealing oven, to avoid any possible flaw.

Molded, the discs are fastened to blockers, or shells, which carry them through the subsequent grinding operations. These require rare skill.

Under the first or "rough" grinding, with a coarse abrasive, the discs are quickly shaped to approximate finished thickness. A second grinding, with a finer abrasive, smooths off the coarseness of the first grinding, and gives the exact curvature required for the finished lens. This operation, highly important, requires constantly uniform pressure.

The third grinding, known as smoothing, is done with a still finer abrasive. This gives a velvet smooth finish to the lens, and is followed by the final grinding with the finest abrasive known.

The next step is polishing. Machines which both rotate and oscillate apply a uniform finish over the entire surface. Two grades of polishing rouge are used; they might be termed the "finest" and "finer than the finest." Polishing, an extremely delicate operation, requires not less than two to four hours. Under-polishing fails to produce an optically true surface; over-polishing may affect the true curvature. During the polishing process, lenses are checked repeatedly with an optically perfect test lens, so that any minute air-spaces between the test lens and the new lens are instantly revealed.

Up to this point only one surface has been completed. The lens, reversed on the blocker, makes its second trip through the plant.

Every lens has two centers—the optical and the geometrical. Since these do not yet coincide, the lens, removed from the blocker, is adjusted on a rotating machine until the optical center is true-running. Now a grinding stone grinds the lens edge down to the correct diameter—a tedious expensive operation.

The lenses are finally individually seated in mounts, turned on bench lathes and true-running chucks to assure exact concentricity and good finish.

THE CARE AND PRESERVATION OF LENSES

A photographic lens is a precise optical instrument and will provide a lifetime of useful service, but must observe commonsense precautions in its handling.

Do not wipe lenses carelessly with any available rag, handkerchief or tissue paper. For the removing of dust, grit, sand, etc., brush them with a fine camel's hair brush. Never touch the glasses if you can possibly avoid doing so, but handle by the mount. Should fingerprints or grease spots nevertheless show on the lens surface, remove them in the following manner:

Dip a swab of soft well washed linen lightly in pure grain alcohol or ether and clean the lens gently. Avoid touching the lacquered metal rims or mounts in this operation as the action of the chemicals may affect the lacquer.

To polish the lens, use a soft, clean, lintless cloth or specially prepared lens tissue.

Do not keep your lenses uncovered, protect them from excessive heat, humidity and dampness. Use metal lens caps which protects them from dust as well as other dangers.

Should it be necessary to unscrew lens elements from the mount, be certain to replace them correctly. Thread them back carefully. Do not tighten them to an extreme point, yet be sure to replace them securely to prevent them from becoming loose. Even a trifling maladjustment will throw your precision lens slightly out of focus.

Lenses other than those intended for use with ground glass focusing back cameras (this includes 8mm, 16mm and 35mm movie cameras as well) are "set" at the factory, so they are in accurate focus for a particular make of camera. By "set" we mean adjusted for the distance between film and lens seat on the camera. The camera maker considers this one of the most important tolerances to maintain. If you know that your lens is in correct focus for a given distance and your negatives are "unsharp," you may be sure that the tolerance is out and both lens and camera should be sent to the factory for proper adjustment.

Presence of bubbles. In the manufacture of the types of optical glass from which the present day photographic lenses are made, it is absolutely impossible for the glass maker to eliminate the presence of these air bubbles.

Their presence, regardless of how many there might be, has so negligible an effect that they should be entirely discounted. They have absolutely no effect on the functioning or correcton and the loss of light transmission is infinitesimal.

When lenses require repair or adjustment, return them to the manufacturer for these adjustments.

DEPTH OF FOCUS *

25mm—1 inch LENS—35mm CAMERAS

Point of Focus	F. 2				F. 2.8				F. 4				F. 5.6				F. 8				F. 11			
					IN FOCUS FROM																			
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
2	1	10 to	2	3	1	9 to	2	4	1	8 to	2	6	1	7 to	2	9	1	5 to	3	4	1	3 to	43	9
3	2	7 to	3	6	2	6 to	3	9	2	4 to	4	3	2	2 to	5	2	1	11 to	7	5	1	8 to	162	6
4	3	4 to	5	0	3	2 to	5	6	2	10 to	6	8	2	7 to	9	0	2	3 to	19	2	1	11 to	Inf.	
5	4	0 to	6	8	3	8 to	8	7	3	4 to	9	10	2	11 to	16	4	2	6 to	504	0	2	2 to	Inf.	
6	4	7 to	8	7	4	3 to	10	4	3	9 to	14	8	3	3 to	36	0	2	9 to	Inf.		2	3 to	Inf.	
7	5	2 to	10	8	4	9 to	13	7	4	2 to	22	7	3	7 to	252	0	2	11 to	Inf.		2	5 to	Inf.	
8	5	9 to	13	3	5	2 to	18	0	4	6 to	38	0	3	9 to	Inf.		3	1 to	Inf.		2	6 to	Inf.	
9	6	3 to	16	3	5	6 to	24	0	4	9 to	80	8	4	0 to	Inf.		3	3 to	Inf.		2	7 to	Inf.	
10	6	8 to	19	10	5	11 to	32	9	5	0 to	810	0	4	2 to	Inf.		3	4 to	Inf.		2	8 to	Inf.	
12	7	6 to	29	6	6	7 to	72	0	5	6 to	Inf.		4	6 to	Inf.		3	7 to	Inf.		2	10 to	Inf.	
14	8	3 to	45	7	7	1 to	504	0	5	10 to	Inf.		4	9 to	Inf.		3	8 to	Inf.		2	11 to	Inf.	
16	8	11 to	77	0	7	7 to	Inf.		6	2 to	Inf.		5	0 to	Inf.		3	10 to	Inf.		3	0 to	Inf.	
18	9	6 to	165	0	8	0 to	Inf.		6	6 to	Inf.		5	2 to	Inf.		3	11 to	Inf.		3	1 to	Inf.	
20	10	0 to	202	0	8	5 to	Inf.		6	9 to	Inf.		5	4 to	Inf.		4	0 to	Inf.		3	1 to	Inf.	
25	11	2 to	Inf.		9	2 to	Inf.		7	3 to	Inf.		5	7 to	Inf.		4	2 to	Inf.		3	2 to	Inf.	
30	12	1 to	Inf.		9	9 to	Inf.		7	7 to	Inf.		5	10 to	Inf.		4	4 to	Inf.		3	3 to	Inf.	
35	12	10 to	Inf.		10	2 to	Inf.		7	10 to	Inf.		6	0 to	Inf.		4	5 to	Inf.		3	4 to	Inf.	
40	13	5 to	Inf.		10	7 to	Inf.		8	0 to	Inf.		6	1 to	Inf.		4	6 to	Inf.		3	4 to	Inf.	
45	14	0 to	Inf.		10	11 to	Inf.		8	2 to	Inf.		6	2 to	Inf.		4	7 to	Inf.		3	5 to	Inf.	
50	14	4 to	Inf.		11	2 to	Inf.		8	5 to	Inf.		6	4 to	Inf.		4	8 to	Inf.		3	5 to	Inf.	

* *Depth of Field*

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

28mm—1⅛ inch LENS—35mm CAMERAS

Point of Focus	F. 2	F. 2.8	F. 4	F. 5.6	F. 8	F. 11
	IN FOCUS FROM					
Feet	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.
3	2 8 to 3 5	2 7 to 3 7	2 5 to 3 11	2 3 to 4 6	2 0 to 5 8	1 10 to 8 7
4	3 6 to 4 9	3 3 to 5 2	3 0 to 5 10	2 9 to 7 2	2 5 to 10 10	2 2 to 29 11
5	4 2 to 6 3	3 11 to 6 11	3 7 to 8 3	3 3 to 11 2	2 9 to 23 7	2 4 to Inf.
6	4 10 to 7 10	4 6 to 9 0	4 0 to 11 4	3 7 to 18 1	3 0 to 111 6	2 7 to Inf.
7	5 6 to 9 8	5 0 to 11 5	4 6 to 15 7	4 0 to 31 7	3 4 to Inf.	2 9 to Inf.
8	6 1 to 11 8	5 7 to 14 4	4 11 to 21 7	4 3 to 72 0	3 6 to Inf.	2 11 to Inf.
9	6 8 to 13 11	6 0 to 17 11	5 3 to 30 10	4 6 to 163 0	3 9 to Inf.	3 0 to Inf.
10	7 2 to 16 6	6 5 to 22 5	5 7 to 47 0	4 9 to Inf.	3 11 to Inf.	3 2 to Inf.
12	8 2 to 22 9	7 3 to 35 7	6 2 to 218 0	5 2 to Inf.	4 2 to Inf.	3 4 to Inf.
14	9 0 to 31 2	7 11 to 62 0	6 8 to Inf.	5 6 to Inf.	4 4 to Inf.	3 6 to Inf.
16	9 10 to 43 3	8 6 to 138 0	7 1 to Inf.	5 9 to Inf.	4 7 to Inf.	3 7 to Inf.
18	10 7 to 62 0	9 2 to 326 0	7 5 to Inf.	6 0 to Inf.	4 8 to Inf.	3 8 to Inf.
20	11 3 to 94 0	9 6 to Inf.	7 9 to Inf.	6 3 to Inf.	4 10 to Inf.	3 9 to Inf.
25	12 7 to 158 6	10 6 to Inf.	8 5 to Inf.	6 7 to Inf.	5 0 to Inf.	3 11 to Inf.
30	13 10 to Inf.	11 3 to Inf.	9 0 to Inf.	6 10 to Inf.	5 3 to Inf.	4 0 to Inf.
35	14 9 to Inf.	11 11 to Inf.	9 4 to Inf.	7 2 to Inf.	5 5 to Inf.	4 1 to Inf.
40	15 7 to Inf.	12 5 to Inf.	9 8 to Inf.	7 5 to Inf.	5 6 to Inf.	4 2 to Inf.
50	16 10 to Inf.	13 4 to Inf.	10 2 to Inf.	7 7 to Inf.	5 7 to Inf.	4 3 to Inf.

**Depth of Field*

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

32mm—1¼ inch LENS—35mm CAMERAS

Point of Focus	F.2				F.2.8				F.4				F.5.6				F.8				F.11			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	2	9 to	3	4	2	8 to	3	5	2	6 to	3	8	2	5 to	4	0	2	2 to	4	11	2	0 to	6	10
4	3	5 to	4	7	3	5 to	4	10	3	3 to	5	3	3	0 to	6	0	2	6 to	8	8	2	4 to	19	6
5	4	4 to	5	11	4	2 to	6	4	3	10 to	7	2	3	6 to	8	8	3	0 to	15	2	2	7 to	29	0
6	5	0 to	7	4	4	9 to	8	0	4	5 to	9	5	4	0 to	12	2	3	4 to	62	6	2	11 to	336	0
7	5	8 to	8	11	5	5 to	9	11	4	11 to	12	2	4	5 to	17	3	3	9 to	97	4	3	2 to	Inf.	
8	6	5 to	10	7	6	0 to	12	1	5	5 to	15	6	4	9 to	24	10	4	0 to	Inf.		3	4 to	Inf.	
9	7	0 to	12	4	6	6 to	14	6	5	10 to	19	10	5	1 to	38		4	2 to	Inf.		3	6 to	Inf.	
10	7	8 to	14	4	7	0 to	17	4	6	3 to	25	5	5	5 to	655		4	6 to	Inf.		3	8 to	Inf.	
12	8	10 to	18	10	7	11 to	24	5	6	11 to	44	0	6	0 to	Inf.		4	10 to	Inf.		3	11 to	Inf.	
14	9	10 to	24	4	8	10 to	34	5	7	7 to	92	5	6	5 to	Inf.		5	2 to	Inf.		4	1 to	Inf.	
16	10	9 to	31	0	9	6 to	49	9	8	2 to	528	0	6	10 to	Inf.		5	5 to	Inf.		4	4 to	Inf.	
18	11	8 to	39	7	10	2 to	75	10	8	7 to	Inf.		7	2 to	Inf.		5	6 to	Inf.		4	5 to	Inf.	
20	12	6 to	50	10	10	10 to	131	0	9	0 to	Inf.		7	5 to	Inf.		5	8 to	Inf.		4	7 to	Inf.	
25	14	3 to	103	3	12	2 to	Inf.		9	11 to	Inf.		8	0 to	Inf.		6	1 to	Inf.		4	10 to	Inf.	
30	15	8 to	330	0	13	2 to	Inf.		10	8 to	Inf.		8	6 to	Inf.		6	4 to	Inf.		5	0 to	Inf.	
35	17	0 to	Inf.		14	1 to	Inf.		11	3 to	Inf.		8	10 to	Inf.		6	6 to	Inf.		5	2 to	Inf.	
40	18	1 to	Inf.		14	10 to	Inf.		11	8 to	Inf.		9	1 to	Inf.		6	7 to	Inf.		5	3 to	Inf.	
45	19	0 to	Inf.		15	6 to	Inf.		12	1 to	Inf.		9	4 to	Inf.		6	10 to	Inf.		5	4 to	Inf.	
50	19	11 to	Inf.		16	0 to	Inf.		12	5 to	Inf.		9	7 to	Inf.		7	0 to	Inf.		5	5 to	Inf.	
60	21	4 to	Inf.		16	11 to	Inf.		13	0 to	Inf.		10	0 to	Inf.		8	1 to	Inf.		6	8 to	Inf.	
75	22	10 to	Inf.		18	0 to	Inf.		13	6 to	Inf.		10	3 to	Inf.		9	2 to	Inf.		7	4 to	Inf.	
100	24	10 to	Inf.		19	1 to	Inf.		14	2 to	Inf.		10	7 to	Inf.		9	8 to	Inf.		7	10 to	Inf.	

*Depth of Field

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

35mm—1-2/5 inch LENS—35mm CAMERAS

IN FOCUS FROM

Point of Focus	F.2					F.2.8					F.4				
Feet	Ft.	In.		Ft.	In.	Ft.	In.		Ft.	In.	Ft.	In.		Ft.	In.
3	2	7	to	3	2	2	6	to	3	3	2	6	to	3	4
4	3	7	to	4	4	3	6	to	4	3	3	3	to	5	0
5	4	4	to	5	7	4	2	to	6	1	4	0	to	6	5
6	5	3	to	7	0	5	0	to	7	6	4	7	to	8	5
7	6	0	to	8	3	5	7	to	9	1	5	2	to	10	8
8	6	7	to	10	0	6	3	to	11	2	5	8	to	13	2
9	7	4	to	11	7	6	10	to	13	3	6	4	to	16	2
10	8	1	to	13	3	7	4	to	15	6	6	7	to	20	0
11	8	7	to	15	1	8	0	to	18	1	7	2	to	24	0
12	9	3	to	17	0	8	10	to	21	0	7	7	to	29	0
13	9	9	to	19	3	9	0	to	24	3	8	0	to	36	0
14	10	4	to	21	6	9	8	to	28	0	8	4	to	45	0
15	10	8	to	24	0	9	9	to	32	4	8	7	to	57	0
16	11	4	to	27	0	10	3	to	37	4	9	0	to	75	0
17	12	2	to	30	0	10	7	to	43	3	9	4	to	106	0
18	12	6	to	33	0	11	5	to	46	3	9	5	to	162	0
20	13	5	to	40	2	11	8	to	70	0	10	0	to	Inf.	
25	15	0	to	65	0	13	3	to	233	4	11	0	to	Inf.	
30	17	0	to	116	0	14	6	to	Inf.		12	0	to	Inf.	
35	18	7	to	303	0	15	8	to	Inf.		12	8	to	Inf.	
40	20	0	to	Inf.		16	6	to	Inf.		13	0	to	Inf.	
45	21	0	to	Inf.		17	4	to	Inf.		13	10	to	Inf.	
50	22	1	to	Inf.		18	0	to	Inf.		14	2	to	Inf.	

Point of Focus	F.5.6					F.8					F.11				
Feet	Ft.	In.		Ft.	In.	Ft.	In.		Ft.	In.	Ft.	In.		Ft.	In.
3	2	5	to	3	7	2	3	to	4	3	2	2	to	5	2
4	3	1	to	5	5	2	8	to	6	5	2	7	to	9	0
5	3	7	to	7	6	3	4	to	10	0	2	11	to	16	5
6	4	3	to	10	0	3	8	to	13	6	3	3	to	36	6
7	4	8	to	13	6	4	3	to	23	0	3	7	to	260	0
8	5	0	to	18	0	4	6	to	40	0	3	9	to	Inf.	
9	5	6	to	24	0	4	7	to	95	0	4	0	to	Inf.	
10	5	9	to	33	0	5	0	to	Inf.		4	2	to	Inf.	
11	6	4	to	47	0	5	3	to	Inf.		4	4	to	Inf.	
12	6	6	to	72	0	5	5	to	Inf.		4	6	to	Inf.	
13	6	9	to	Inf.		5	8	to	Inf.		4	7	to	Inf.	
14	7	0	to	Inf.		6	0	to	Inf.		4	9	to	Inf.	
15	7	3	to	Inf.		6	2	to	Inf.		4	10	to	Inf.	
16	7	5	to	Inf.		6	3	to	Inf.		5	0	to	Inf.	
17	7	8	to	Inf.		6	4	to	Inf.		5	1	to	Inf.	
18	8	0	to	Inf.		6	5	to	Inf.		5	2	to	Inf.	
20	8	3	to	Inf.		6	7	to	Inf.		5	4	to	Inf.	
25	9	0	to	Inf.		7	2	to	Inf.		5	7	to	Inf.	
30	10	0	to	Inf.		7	5	to	Inf.		5	10	to	Inf.	
35	10	1	to	Inf.		7	7	to	Inf.		5	11	to	Inf.	
40	10	5	to	Inf.		7	8	to	Inf.		6	1	to	Inf.	
45	10	10	to	Inf.		8	1	to	Inf.		6	2	to	Inf.	
50	11	0	to	Inf.		8	3	to	Inf.		6	3	to	Inf.	

**Depth of Field*

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

40mm—1⅝ inch LENS—35mm CAMERAS

Point of Focus	F.2				F.2.3				F.2.8				F.3.2				F.4				F.4.5			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	2	10 to	3	2	2	10 to	3	2	2	9 to	3	4	2	9 to	3	4	2	8 to	3	5	2	8 to	3	5
4	3	9 to	4	4	3	8 to	4	5	3	7 to	4	6	3	7 to	4	7	3	6 to	4	8	3	5 to	4	10
5	4	6 to	5	6	4	6 to	5	8	3	7 to	5	10	4	4 to	5	11	4	2 to	6	2	4	1 to	6	5
6	5	5 to	6	10	5	4 to	6	11	5	2 to	7	2	5	0 to	7	4	4	10 to	7	10	4	9 to	8	2
7	6	2 to	8	1	6	0 to	8	4	5	11 to	8	8	5	9 to	8	11	5	6 to	9	7	5	4 to	10	1
8	6	11 to	9	6	6	10 to	9	9	6	7 to	10	3	6	5 to	10	8	6	1 to	11	7	5	11 to	12	4
9	7	8 to	10	11	7	6 to	11	3	7	3 to	11	11	7	0 to	12	6	6	8 to	13	10	6	5 to	14	10
10	8	5 to	12	5	8	2 to	12	10	7	10 to	13	9	7	8 to	14	7	7	2 to	16	4	6	11 to	17	10
12	9	9 to	15	7	9	6 to	16	4	9	0 to	17	10	8	9 to	19	2	8	2 to	22	5	7	11 to	25	4
14	11	0 to	19	3	10	8 to	20	4	10	2 to	22	8	9	9 to	24	11	9	10 to	30	7	8	8 to	36	4
16	12	2 to	23	2	11	10 to	24	10	11	3 to	28	4	10	8 to	32	0	9	10 to	42	3	9	5 to	53	9
18	13	4 to	27	9	12	10 to	30	0	12	1 to	35	2	11	6 to	41	3	10	7 to	59	9	10	0 to	85	8
20	14	5 to	32	9	13	10 to	36	0	13	0 to	43	10	12	4 to	53	3	11	3 to	89	6	10	8 to	Inf.	
25	16	10 to	48	6	16	2 to	55	2	14	11 to	78	0	14	0 to	114	3	12	8 to	Inf.		11	9 to	Inf.	
30	19	0 to	71	11	18	0 to	90	0	16	6 to	162	6	15	6 to	480	0	13	10 to	Inf.		13	0 to	Inf.	
35	20	10 to	109	6	19	9 to	157	6	18	0 to	308	6	16	8 to	Inf.		14	10 to	Inf.		13	8 to	Inf.	
40	22	6 to	179	0	21	2 to	360	0	19	2 to	Inf.		17	10 to	Inf.		15	7 to	Inf.		14	6 to	Inf.	
45	23	0 to	357	0	22	6 to	Inf.		20	5 to	Inf.		18	8 to	Inf.		16	5 to	Inf.		15	2 to	Inf.	
50	25	4 to	Inf.		23	9 to	Inf.		21	3 to	Inf.		19	6 to	Inf.		17	0 to	Inf.		15	8 to	Inf,	
60	27	10 to	Inf.		25	9 to	Inf.		22	2 to	Inf.		20	11 to	Inf.		18	0 to	Inf.		16	6 to	Inf.	
75	30	7 to	Inf.		28	1 to	Inf.		24	11 to	Inf.		22	5 to	Inf.		19	3 to	Inf.		17	6 to	Inf.	
100	34	0 to	Inf.		31	0 to	Inf.		27	0 to	Inf.		24	2 to	Inf.		24	7 to	Inf.		18	7 to	Inf	

**Depth of Field*

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

40mm—1⅝ inch LENS—35mm CAMERAS

Point of Focus	F.5.6				F.6.3				F.8				F.9.1				F.11				F.16			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In
3	2	7 to	3	7	2	6 to	3	8	2	5 to	3	11	2	5 to	4	0	2	5 to	4	5	2	1 to	5	7
4	3	3 to	5	2	3	2 to	5	4	3	0 to	5	10	3	0 to	6	2	2	10 to	7	0	2	6 to	10	6
5	3	11 to	6	10	3	10 to	7	3	3	7 to	8	2	3	6 to	9	0	3	6 to	10	9	2	10 to	22	2
6	4	6 to	8	11	4	5 to	9	6	4	0 to	11	3	3	11 to	12	10	3	8 to	16	9	3	1 to	86	0
7	5	0 to	11	3	4	11 to	12	4	4	6 to	15	5	4	4 to	18	0	4	0 to	27	10	3	4 to	Inf.	
8	5	7 to	14	2	5	4 to	15	9	4	11 to	21	4	4	8 to	27	5	4	4 to	55	6	3	8 to	Inf.	
9	6	0 to	17	8	5	10 to	20	0	5	4 to	30	1	5	0 to	44	5	4	7 to	240	0	3	9 to	Inf.	
10	6	6 to	22	0	6	2 to	25	11	5	7 to	45	0	5	4 to	87	0	4	10 to	Inf.		3	11 to	Inf.	
12	7	4 to	34	9	6	11 to	45	5	6	2 to	181	6	5	10 to	Inf.		5	3 to	Inf.		4	2 to	Inf.	
14	7	11 to	59	0	7	7 to	99	4	6	8 to	Inf.		6	3 to	Inf.		5	7 to	Inf.		4	5 to	Inf.	
16	8	7 to	125	0	8	0 to	Inf.		7	2 to	Inf.		6	7 to	Inf.		5	11 to	Inf.		4	7 to	Inf.	
18	9	1 to	Inf.		8	7 to	Inf.		7	6 to	Inf.		6	11 to	Inf.		6	2 to	Inf.		4	9 to	Inf.	
20	9	7 to	Inf.		9	3 to	Inf.		7	10 to	Inf.		7	3 to	Inf.		6	5 to	Inf.		4	11 to	Inf.	
25	10	7 to	Inf.		9	11 to	Inf.		8	6 to	Inf.		7	9 to	Inf.		6	10 to	Inf.		5	2 to	Inf.	
30	11	5 to	Inf.		10	7 to	Inf.		9	0 to	Inf.		8	3 to	Inf.		7	2 to	Inf.		5	4 to	Inf.	
35	12	0 to	Inf.		11	1 to	Inf.		9	5 to	Inf.		8	7 to	Inf.		7	5 to	Inf.		5	6 to	Inf.	
40	12	7 to	Inf.		11	7 to	Inf.		9	9 to	Inf.		8	10 to	Inf.		7	7 to	Inf.		5	7 to	Inf.	
45	13	0 to	Inf.		12	2 to	Inf.		10	0 to	Inf.		9	0 to	Inf.		7	9 to	Inf.		5	8 to	Inf.	
50	13	5 to	Inf.		12	4 to	Inf.		10	3 to	Inf.		9	3 to	Inf.		7	11 to	Inf.		5	10 to	Inf.	
60	14	0 to	Inf.		12	10 to	Inf.		10	7 to	Inf.		9	6 to	Inf.		8	1 to	Inf.		5	10 to	Inf.	
75	14	10 to	Inf.		13	5 to	Inf.		11	0 to	Inf.		9	10 to	Inf.		8	4 to	Inf.		5	11 to	Inf.	
100	15	5 to	Inf.		14	0 to	Inf.		11	4 to	Inf.		10	2 to	Inf.		8	7 to	Inf.		6	0 to	Inf.	

**Depth of Field*

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

50mm—2 inch LENS—35mm CAMERAS

Point of Focus	F.2				F.2.3				F.2.8				F.3.2				F.4				F.4.5			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	2	11 to	3	1	2	11 to	3	2	2	10 to	3	2	2	10 to	3	2	2	10 to	3	3	2	9 to	3	3
4	3	10 to	4	2	3	11 to	4	3	3	9 to	4	3	3	8 to	4	3	3	8 to	4	5	3	7 to	4	6
5	4	9 to	5	4	4	8 to	5	5	4	7 to	5	5	4	7 to	5	7	4	6 to	5	8	4	5 to	5	10
6	5	7 to	6	6	5	6 to	6	7	5	5 to	6	8	5	5 to	6	10	5	3 to	7	0	5	2 to	7	2
7	6	6 to	7	8	6	5 to	7	9	6	3 to	7	11	6	2 to	8	2	6	0 to	8	5	5	10 to	8	8
8	7	4 to	8	11	7	2 to	9	0	7	0 to	9	3	6	11 to	9	6	6	8 to	9	11	6	7 to	10	3
9	8	2 to	10	1	8	0 to	10	4	7	10 to	10	7	7	8 to	10	11	7	5 to	11	6	7	2 to	12	0
10	8	11 to	11	4	8	9 to	11	8	8	7 to	12	0	8	4 to	12	5	8	0 to	13	2	7	10 to	13	10
12	10	6 to	14	0	10	3 to	14	5	10	0 to	15	0	9	8 to	15	9	9	4 to	16	11	9	0 to	18	0
14	12	0 to	16	10	11	8 to	17	5	11	4 to	18	4	11	0 to	19	4	10	6 to	21	1	10	1 to	22	11
16	13	5 to	19	10	13	1 to	20	8	12	7 to	21	11	12	2 to	23	5	11	7 to	26	0	11	1 to	28	10
18	14	10 to	23	0	14	4 to	24	2	13	10 to	25	10	13	3 to	28	0	12	7 to	31	10	12	0 to	36	0
20	16	1 to	26	4	15	7 to	27	10	14	11 to	30	0	14	4 to	33	1	13	6 to	38	6	12	10 to	45	0
25	19	3 to	35	10	18	6 to	38	6	17	7 to	43	3	16	9 to	49	6	15	8 to	62	9	14	9 to	81	9
30	22	1 to	46	10	21	0 to	52	0	19	11 to	60	6	18	10 to	74	0	17	5 to	107	0	16	4 to	180	0
35	24	8 to	60	3	23	5 to	69	0	22	0 to	80	0	20	8 to	114	0	19	0 to	221	0	17	9 to	Inf.	
40	27	1 to	76	9	25	7 to	91	6	23	11 to	122	0	22	4 to	191	0	20	5 to	Inf.		19	0 to	Inf.	
45	29	4 to	97	6	27	7 to	123	0	26	10 to	185	0	23	10 to	412	6	21	7 to	Inf.		20	0 to	Inf.	
50	31	4 to	125	0	29	4 to	169	0	27	2 to	313	0	25	1 to	505	0	22	10 to	Inf.		21	0 to	Inf.	
60	35	0 to	213	0	32	6 to	387	6	29	11 to	Inf.		27	5 to	Inf.		24	7 to	Inf.		22	6 to	Inf.	
75	39	6 to	Inf.		36	6 to	Inf.		33	2 to	Inf.		30	2 to	Inf.		26	10 to	Inf.		24	4 to	Inf.	
100	45	6 to	Inf.		41	6 to	Inf.		37	4 to	Inf.		33	6 to	Inf.		29	3 to	Inf.		26	5 to	Inf.	

**Depth of Field*

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

50mm—2 inch LENS—35mm CAMERAS

Point of Focus	F.5.6				F.6.3				F.8				F.9.1				F.11				F.16			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	2	9 to	3	4	2	8 to	3	5	2	8 to	3	6	2	7 to	3	7	2	6 to	3	9	2	4 to	4	3
4	3	6 to	4	8	3	6 to	4	9	3	4 to	5	0	3	3 to	5	2	3	2 to	5	5	2	11 to	6	7
5	4	3 to	6	0	4	2 to	6	2	4	0 to	6	7	3	11 to	6	11	3	9 to	7	7	3	4 to	9	10
6	5	0 to	7	6	4	10 to	7	10	4	8 to	8	5	4	6 to	9	0	4	3 to	10	0	3	9 to	14	8
7	5	8 to	9	2	5	6 to	9	7	5	3 to	10	7	5	0 to	11	6	4	10 to	13	0	4	2 to	23	7
8	6	4 to	10	11	6	1 to	11	7	5	9 to	13	0	5	4 to	14	5	5	3 to	17	0	4	6 to	37	10
9	6	11 to	12	11	6	8 to	13	10	6	4 to	15	11	6	0 to	17	11	5	8 to	22	2	4	9 to	79	6
10	7	6 to	15	0	7	2 to	16	4	6	9 to	19	3	6	5 to	22	7	6	0 to	29	5	5	0 to	Inf.	
12	8	7 to	20	1	8	2 to	22	5	7	8 to	28	5	7	2 to	36	5	6	8 to	57	9	5	6 to	Inf.	
14	9	6 to	26	5	9	1 to	30	7	8	4 to	42	10	7	10 to	64	4	7	4 to	184	6	5	11 to	Inf.	
16	10	5 to	34	7	9	11 to	42	2	9	0 to	69	6	8	5 to	151	0	7	10 to	Inf.		6	3 to	Inf.	
18	11	2 to	45	6	10	7 to	59	7	9	8 to	133	6	9	0 to	Inf.		8	3 to	Inf.		6	6 to	Inf.	
20	11	11 to	61	0	11	3 to	89	0	10	2 to	520	0	9	5 to	Inf.		8	8 to	Inf.		6	9 to	Inf.	
25	13	7 to	156	6	12	6 to	Inf.		11	4 to	Inf.		10	5 to	Inf.		9	5 to	Inf.		7	3 to	Inf.	
30	14	11 to	Inf.		13	11 to	Inf.		12	4 to	Inf.		11	3 to	Inf.		10	0 to	Inf.		7	7 to	Inf.	
35	16	1 to	Inf.		14	10 to	Inf.		13	0 to	Inf.		11	10 to	Inf.		10	7 to	Inf.		7	10 to	Inf.	
40	17	0 to	Inf		15	8 to	Inf.		13	8 to	Inf.		12	4 to	Inf.		11	0 to	Inf.		8	1 to	Inf.	
45	17	11 to	Inf.		16	5 to	Inf.		14	3 to	Inf.		12	10 to	Inf.		11	4 to	Inf.		8	3 to	Inf.	
50	18	7 to	Inf.		17	0 to	Inf.		14	8 to	Inf.		13	2 to	Inf.		11	8 to	Inf.		8	5 to	Inf.	
60	19	10 to	Inf.		18	0 to	Inf.		15	5 to	Inf.		13	10 to	Inf.		12	1 to	Inf.		8	9 to	Inf.	
75	22	4 to	Inf.		19	2 to	Inf.		16	3 to	Inf.		14	6 to	Inf.		12	7 to	Inf.		8	11 to	Inf.	
100	22	11 to	Inf.		20	6 to	Inf.		17	3 to	Inf.		15	2 to	Inf.		13	1 to	Inf.		9	2 to	Inf.	

**Depth of Field*

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

75mm—3 inch LENS—35mm CAMERAS

Point of Focus	F.2				F.2.3				F.2.8				F.3.2				F.4				F.4.5			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	2	11 to	3	0	2	11 to	3	0	2	11 to	3	0	2	11 to	3	0	2	11 to	3	1	2	11 to	3	2
4	3	11 to	4	1	3	11 to	4	1	3	11 to	4	2	3	10 to	4	2	3	10 to	4	2	3	10 to	4	2
5	4	10 to	5	2	4	10 to	5	2	4	10 to	5	2	4	10 to	5	3	4	9 to	5	3	4	9 to	5	4
6	5	10 to	6	2	5	9 to	6	3	5	9 to	6	4	5	8 to	6	4	5	8 to	6	5	5	7 to	6	6
7	6	9 to	7	3	6	8 to	7	4	6	8 to	7	5	6	7 to	7	5	6	6 to	7	7	6	5 to	7	8
8	7	8 to	8	4	7	7 to	8	5	7	7 to	8	6	7	6 to	8	7	7	4 to	9	9	7	3 to	8	11
9	8	7 to	9	5	8	6 to	9	7	8	5 to	9	8	8	4 to	9	9	8	2 to	10	0	8	1 to	10	2
10	9	6 to	10	7	9	5 to	10	8	9	4 to	10	10	9	3 to	10	11	9	0 to	11	2	8	11 to	11	5
12	11	2 to	12	10	11	2 to	13	0	11	0 to	13	2	10	11 to	13	4	10	8 to	13	10	10	6 to	14	2
14	13	0 to	15	1	12	10 to	15	4	12	8 to	15	8	12	6 to	15	11	12	2 to	16	5	11	11 to	17	0
16	14	8 to	17	5	14	6 to	17	10	14	4 to	18	2	14	1 to	18	6	13	8 to	19	4	13	4 to	20	0
18	16	5 to	19	11	16	2 to	20	4	15	11 to	20	10	15	7 to	21	4	15	1 to	22	4	14	8 to	23	2
20	18	1 to	22	5	17	9 to	22	11	17	5 to	23	6	17	1 to	24	2	16	6 to	25	5	16	0 to	26	7
25	22	0 to	28	10	21	7 to	29	7	21	1 to	30	9	20	7 to	31	10	19	8 to	34	2	19	0 to	36	2
30	25	10 to	35	7	25	7 to	37	0	24	7 to	38	9	23	11 to	40	0	22	9 to	44	3	21	10 to	47	10
35	29	6 to	43	0	28	7 to	44	11	27	10 to	47	3	26	11 to	50	0	25	6 to	56	0	24	5 to	61	11
40	33	0 to	50	10	31	11 to	53	7	30	11 to	57	0	29	10 to	60	10	28	0 to	70	0	26	8 to	79	5
45	36	3 to	59	4	35	0 to	62	10	33	10 to	67	8	32	6 to	73	0	30	5 to	86	9	28	10 to	102	0
50	39	10 to	68	0	38	0 to	73	3	36	6 to	79	9	35	0 to	87	6	32	6 to	107	5	30	10 to	132	0
60	45	6 to	88	3	43	5 to	96	9	41	6 to	108	3	39	7 to	123	0	36	6 to	167	6	34	5 to	236	0
75	53	6 to	125	0	51	0 to	143	0	48	3 to	170	0	45	7 to	209	0	41	7 to	397	0	38	10 to	Inf.	
100	65	3 to	214	6	61	3 to	273	0	57	6 to	391	0	54	0 to	690	0	48	3 to	Inf.		44	6 to	Inf.	

*Depth of Field

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

75mm—3 inch LENS—35mm CAMERAS

Point of Focus	F.5.6				F.6.3				F.8				F.9.1				F.11				F.16			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	2	10 to	3	2	2	10 to	3	2	2	10 to	3	2	2	9 to	3	3	2	9 to	3	3	2	8 to	3	6
4	3	9 to	4	3	3	9 to	4	4	3	8 to	4	5	3	8 to	4	5	3	7 to	4	6	3	5 to	4	10
5	4	8 to	5	5	4	7 to	5	6	4	6 to	5	7	4	5 to	5	9	4	4 to	5	11	4	0 to	6	5
6	5	6 to	6	7	5	5 to	6	8	5	4 to	6	10	5	3 to	7	0	5	1 to	7	3	4	9 to	8	1
7	6	4 to	7	10	6	3 to	8	0	6	1 to	8	3	6	0 to	8	6	5	10 to	8	10	5	4 to	10	2
8	7	2 to	9	1	7	0 to	9	4	6	10 to	9	8	6	8 to	10	0	6	6 to	10	5	5	11 to	12	4
9	7	11 to	10	7	7	9 to	10	8	7	7 to	11	2	7	4 to	11	7	7	1 to	12	3	6	5 to	14	11
10	8	8 to	11	9	8	6 to	12	1	8	3 to	13	1	8	0 to	13	4	7	9 to	14	2	6	11 to	17	11
12	10	2 to	14	7	9	11 to	15	2	9	7 to	16	2	9	3 to	17	2	8	10 to	18	6	7	10 to	25	6
14	11	7 to	17	8	11	3 to	18	6	10	9 to	20	0	10	5 to	21	7	9	11 to	23	10	8	8 to	36	9
16	12	11 to	21	0	12	7 to	22	2	11	11 to	24	3	11	5 to	26	8	10	10 to	30	2	9	5 to	54	6
18	14	2 to	24	7	13	8 to	26	2	13	0 to	29	4	12	5 to	32	9	11	10 to	38	4	10	0 to	87	6
20	15	5 to	28	7	14	10 to	30	7	14	0 to	35	0	13	4 to	40	0	12	7 to	48	7	10	7 to	170	6
25	16	10 to	36	11	17	5 to	44	3	16	4 to	53	9	15	5 to	66	9	14	5 to	94	6	11	10 to	Inf.	
30	20	9 to	54	4	19	8 to	62	7	18	4 to	83	9	17	2 to	120	0	15	11 to	255	0	12	11 to	Inf.	
35	23	5 to	73	0	21	10 to	89	6	20	0 to	139	6	18	8 to	280	0	17	3 to	Inf.		13	9 to	Inf.	
40	25	0 to	99	3	23	7 to	131	5	21	7 to	250	0	20	0 to	Inf.		18	5 to	Inf.		14	5 to	Inf.	
45	26	10 to	137	0	25	2 to	207	0	23	0 to	Inf.		21	2 to	Inf.		19	5 to	Inf.		15	0 to	Inf.	
50	28	7 to	197	0	26	9 to	384	0	24	2 to	Inf.		22	3 to	Inf.		20	4 to	Inf.		15	6 to	Inf.	
60	31	7 to	572	6	29	5 to	Inf.		26	3 to	Inf.		24	0 to	Inf.		21	9 to	Inf.		16	5 to	Inf.	
75	35	5 to	Inf.		32	6 to	Inf.		28	10 to	Inf.		26	1 to	Inf.		23	5 to	Inf.		17	5 to	Inf.	
100	40	1 to	Inf.		36	6 to	Inf.		31	10 to	Inf.		28	7 to	Inf.		25	4 to	Inf.		18	6 to	Inf.	

*Depth of Field

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

100mm—4 inch LENS—35mm CAMERAS

Point of Focus	F.2				F.2.3				F.2.8				F.3.2				F.4				F.4.5			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	3	0 to	3	0	3	0 to	3	0	3	0 to	3	0	2	11 to	3	0	2	11 to	3	0	2	11 to	3	0
4	4	0 to	4	0	4	0 to	4	0	3	11 to	4	1	3	11 to	4	1	3	11 to	4	1	3	11 to	4	2
5	4	11 to	5	0	4	11 to	5	1	4	11 to	5	1	4	11 to	5	2	4	10 to	5	2	4	10 to	5	2
6	5	11 to	6	2	5	11 to	6	2	5	10 to	6	2	5	10 to	6	2	5	10 to	6	3	5	9 to	6	3
7	6	11 to	7	2	6	10 to	7	2	6	10 to	7	2	6	9 to	7	3	6	9 to	7	4	6	8 to	7	4
8	7	10 to	8	3	7	10 to	8	3	7	9 to	8	3	7	8 to	8	4	7	8 to	8	5	7	7 to	8	6
9	8	9 to	9	3	8	9 to	9	4	8	8 to	9	4	8	8 to	9	5	8	6 to	9	6	8	6 to	9	7
10	9	9 to	10	4	9	8 to	10	4	9	10 to	10	5	9	7 to	10	6	9	5 to	10	7	9	4 to	10	9
12	10	7 to	12	6	11	6 to	12	10	11	5 to	12	7	11	4 to	12	9	11	2 to	12	11	11	1 to	13	0
14	13	5 to	14	7	13	4 to	14	8	13	2 to	14	11	13	2 to	15	0	12	11 to	15	4	12	9 to	15	5
16	15	3 to	16	10	15	2 to	16	11	15	0 to	17	2	14	11 to	17	4	14	7 to	17	8	14	5 to	17	11
18	17	2 to	19	1	17	0 to	19	2	16	9 to	19	6	16	7 to	19	8	16	3 to	20	2	16	0 to	20	6
20	18	11 to	21	4	18	9 to	21	6	18	5 to	21	10	18	3 to	22	1	17	11 to	22	9	17	7 to	23	1
25	23	4 to	27	0	23	0 to	27	5	22	8 to	28	0	22	4 to	28	5	21	9 to	29	5	21	5 to	30	1
30	27	6 to	33	0	27	3 to	33	7	26	7 to	34	2	26	2 to	35	0	25	5 to	36	6	25	0 to	37	8
35	31	8 to	39	2	31	4 to	39	10	30	6 to	41	0	30	0 to	42	2	29	0 to	44	3	28	4 to	45	10
40	35	10 to	45	6	35	4 to	46	6	34	4 to	48	2	33	4 to	49	6	32	4 to	52	7	31	6 to	54	10
45	39	9 to	52	2	39	0 to	53	5	37	11 to	55	6	37	0 to	57	6	35	5 to	61	6	34	6 to	64	8
50	43	6 to	59	0	42	9 to	60	6	41	5 to	63	2	40	4 to	65	6	38	6 to	71	5	37	4 to	75	6
60	51	0 to	73	6	49	10 to	75	9	48	0 to	80	0	46	6 to	84	2	44	3 to	93	9	42	6 to	101	0
75	61	5 to	92	0	59	9 to	101	4	57	0 to	109	3	55	2 to	117	6	51	10 to	136	0	49	10 to	152	0
100	77	0 to	143	0	74	6 to	152	2	70	6 to	171	9	67	7 to	192	6	62	6 to	249	0	59	7 to	308	0

*Depth of Field

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS *

100mm—4 inch LENS—35mm CAMERAS

Point of Focus	F.5.6				F.6.3				F.8				F.9.1				F.11				F.16			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	2	11 to	3	0	2	11 to	3	0	2	11 to	3	2	2	11 to	3	2	2	10 to	3	2	2	10 to	3	3
4	3	11 to	4	2	3	10 to	4	2	3	10 to	4	2	3	10 to	4	3	3	9 to	4	3	3	8 to	4	5
5	4	10 to	5	8	4	9 to	5	3	4	9 to	5	4	4	8 to	5	4	4	7 to	5	5	4	6 to	5	8
6	5	9 to	6	4	5	8 to	6	4	5	7 to	6	6	5	7 to	6	6	5	5 to	6	8	5	3 to	7	0
7	6	8 to	7	5	6	7 to	7	6	6	5 to	7	8	6	5 to	7	9	6	3 to	7	11	6	0 to	8	5
8	7	6 to	8	7	7	5 to	8	8	7	4 to	8	11	7	3 to	9	0	7	1 to	9	3	6	8 to	9	11
9	8	5 to	9	9	8	4 to	9	10	8	2 to	10	1	8	0 to	10	3	7	10 to	10	7	7	5 to	11	6
10	9	3 to	10	11	9	2 to	11	0	8	11 to	11	4	8	10 to	11	7	8	7 to	12	0	8	0 to	13	2
12	10	11 to	13	4	10	10 to	13	7	10	6 to	14	0	10	4 to	14	4	10	0 to	15	0	9	4 to	16	10
14	12	6 to	15	10	12	4 to	16	2	12	0 to	16	10	11	9 to	17	4	11	5 to	18	2	10	6 to	21	0
16	14	1 to	18	6	13	11 to	18	10	13	5 to	19	10	13	2 to	20	6	12	8 to	21	9	11	7 to	26	0
18	15	8 to	21	2	15	5 to	21	9	14	10 to	23	0	14	6 to	23	10	13	11 to	25	7	12	7 to	31	8
20	17	2 to	24	0	16	10 to	24	9	16	1 to	26	4	15	9 to	27	6	15	0 to	29	11	13	6 to	38	5
25	20	9 to	31	7	20	2 to	32	10	19	3 to	35	9	18	8 to	37	10	17	8 to	42	7	15	8 to	62	6
30	24	0 to	40	0	23	5 to	41	10	22	0 to	46	10	21	4 to	50	9	20	1 to	59	6	17	5 to	106	8
35	27	0 to	49	6	26	4 to	52	3	24	9 to	60	3	23	9 to	66	9	22	2 to	83	0	19	0 to	217	10
40	30	0 to	60	2	29	0 to	64	3	27	0 to	76	9	25	11 to	88	0	24	1 to	118	0	20	5 to	980	
45	32	9 to	72	3	31	6 to	78	2	29	4 to	97	7	27	11 to	116	0	25	10 to	175	6	21	7 to	Inf.	
50	35	2 to	86	0	34	0 to	94	6	31	4 to	124	5	29	9 to	156	4	27	4 to	288	0	22	9 to	Inf.	
60	40	0 to	120	6	38	4 to	138	6	34	11 to	213	0	33	0 to	326	0	30	1 to	726	0	24	7 to	Inf.	
75	46	1 to	201	0	43	10 to	256	6	39	6 to	738	0	37	0 to	Inf.		33	5 to	Inf.		26	0 to	Inf.	
100	54	6 to	612	5	51	6 to	Inf.		45	6 to	Inf.		42	3 to	Inf.		37	9 to	Inf.		29	5 to	Inf.	

*Depth of Field

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS*

125 MM.—5 INCH LENS—35MM. CAMERAS

Point of Focus	F.2.8	F.3.5	F.4	F.4.5	F.5.6	F.6.3
	IN FOCUS FROM					
Feet	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.
3	3 0 to 3 0	3 0 to 3 0	3 0 to 3 0	3 0 to 3 0	3 0 to 3 1	3 0 to 3 1
4	3 11 to 4 1	3 11 to 4 1	3 11 to 4 1	3 11 to 4 1	3 11 to 4 1	3 11 to 4 1
5	4 11 to 5 1	4 11 to 5 1	4 11 to 5 1	4 11 to 5 1	4 11 to 5 2	4 11 to 5 2
6	5 11 to 6 1	5 11 to 6 1	5 10 to 6 2	5 10 to 6 2	5 10 to 6 2	5 10 to 6 2
7	6 10 to 7 2	6 10 to 7 2	6 10 to 7 2	6 10 to 7 2	6 9 to 7 3	6 9 to 7 3
8	7 6 to 8 2	7 10 to 8 3	7 9 to 8 3	7 9 to 8 3	7 8 to 8 4	7 8 to 8 5
9	8 9 to 9 3	8 9 to 9 3	8 9 to 9 4	8 8 to 9 4	8 7 to 9 5	8 6 to 9 6
10	9 9 to 10 4	9 8 to 10 4	9 8 to 10 5	9 7 to 10 5	9 6 to 10 7	9 5 to 10 8
12	11 8 to 12 5	11 7 to 12 6	11 6 to 12 7	11 5 to 12 8	11 4 to 12 10	11 2 to 13 0
14	13 6 to 14 7	13 5 to 14 8	13 4 to 14 9	13 3 to 14 10	13 1 to 15 1	12 11 to 15 5
16	15 4 to 16 9	15 2 to 16 11	15 1 to 17 0	15 0 to 17 2	14 9 to 17 6	14 6 to 17 10
18	17 3 to 19 0	17 0 to 19 2	16 10 to 19 4	16 9 to 19 6	16 5 to 19 11	16 1 to 20 5
20	18 11 to 21 2	18 9 to 21 5	18 7 to 21 8	18 5 to 21 10	18 1 to 22 4	17 9 to 22 11
25	23 4 to 27 0	23 1 to 27 3	22 10 to 27 7	22 7 to 28 0	22 1 to 28 10	21 6 to 29 10
30	27 9 to 32 8	27 3 to 33 4	26 11 to 33 10	26 7 to 34 5	25 11 to 35 8	25 2 to 37 2
35	32 0 to 38 8	31 4 to 39 7	30 11 to 40 4	30 5 to 41 2	29 6 to 43 0	27 7 to 45 2
40	36 0 to 44 10	35 4 to 46 2	34 9 to 47 2	34 2 to 48 3	33 0 to 50 10	31 10 to 54 4
45	40 2 to 51 8	39 2 to 52 11	38 5 to 54 4	37 9 to 55 9	36 4 to 59 2	35 0 to 64 5
50	43 9 to 58 0	42 10 to 60 0	42 0 to 61 9	41 2 to 63 8	39 6 to 68 2	37 10 to 74 5
60	51 3 to 71 8	50 0 to 75 0	48 10 to 77 10	47 9 to 80 10	45 3 to 88 3	43 2 to 99 6
75	62 0 to 94 8	60 0 to 100 1	58 4 to 105 1	56 9 to 110 8	53 6 to 125 2	50 8 to 150 8
100	76 1 to 131 0	74 11 to 150 3	72 4 to 161 11	69 11 to 175 6	65 2 to 215 3	61 4 to 320 0

*Depth of Field.

Calculated at 1/500 inch Circle of Confusion

DEPTH OF FOCUS

125 MM.—5 INCH LENS—35 MM. CAMERAS

Point of Focus	F.8	F.9.1	F.11	F.16	F.22	F.32
	IN FOCUS FROM					
Feet	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.
3	2 11 to 3 1	2 11 to 3 1	2 11 to 3 1	2 11 to 3 1	2 10 to 3 2	2 9 to 3 3
4	3 11 to 4 1	3 11 to 4 1	3 10 to 4 2	3 9 to 4 3	3 9 to 4 4	3 7 to 4 6
5	4 10 to 5 2	4 10 to 5 2	4 9 to 5 3	4 8 to 5 5	4 7 to 5 6	4 5 to 5 10
6	5 9 to 6 3	5 9 to 6 4	5 8 to 6 5	5 6 to 6 7	5 4 to 6 10	5 1 to 7 3
7	6 8 to 7 4	6 8 to 7 5	6 7 to 7 6	6 4 to 7 9	6 2 to 8 2	5 10 to 8 9
8	7 7 to 8 6	7 6 to 8 7	7 5 to 8 8	7 2 to 9 1	6 11 to 9 6	6 6 to 10 5
9	8 5 to 9 8	8 4 to 9 10	8 3 to 9 11	7 11 to 10 4	7 7 to 11 0	7 1 to 12 3
10	9 4 to 10 10	9 3 to 11 0	9 1 to 11 2	8 9 to 11 9	8 4 to 12 6	7 9 to 14 2
12	11 0 to 13 2	10 10 to 13 5	10 8 to 13 8	10 2 to 14 7	9 8 to 15 11	8 10 to 18 8
14	12 8 to 15 8	12 5 to 16 0	12 3 to 16 4	11 7 to 17 8	10 11 to 19 8	9 11 to 24 0
16	14 3 to 18 2	14 0 to 18 8	13 9 to 19 2	12 11 to 21 0	12 0 to 23 10	10 10 to 30 8
18	15 10 to 20 10	15 6 to 21 6	15 2 to 22 1	14 2 to 24 8	13 2 to 28 8	11 8 to 39 2
20	17 5 to 23 6	17 0 to 24 5	16 7 to 25 3	15 5 to 28 7	14 2 to 34 1	12 6 to 50 2
25	21 0 to 30 10	20 7 to 32 6	19 10 to 33 9	18 2 to 40 2	16 5 to 52 0	14 3 to 102 1
30	24 5 to 38 10	23 8 to 41 4	22 10 to 43 8	20 8 to 55 0	18 6 to 79 11	15 9 to 328 9
35	27 8 to 47 8	26 8 to 51 1	25 8 to 55 2	22 10 to 74 8	20 3 to 129 9	17 0 to Inf.
40	30 8 to 57 6	29 5 to 63 0	28 3 to 68 9	24 11 to 102 0	21 9 to 243 9	18 1 to Inf.
45	33 6 to 68 5	32 0 to 76 6	30 7 to 85 0	26 9 to 142 9	23 2 to 769 3	19 0 to Inf.
50	36 3 to 80 9	34 6 to 92 6	32 10 to 104 11	28 5 to 209 9	24 5 to Inf.	19 10 to Inf.
60	41 2 to 110 7	39 0 to 136 8	36 10 to 161 9	31 4 to 707 7	26 7 to Inf.	21 5 to Inf.
75	47 8 to 176 7	44 8 to 265 0	41 11 to 353 0	34 11 to Inf.	29 2 to Inf.	22 9 to Inf.
100	56 8 to 425 1	52 9 to Inf.	48 9 to Inf.	39 6 to Inf.	32 3 to Inf.	24 8 to Inf.

*Depth of Field.

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS*

150 mm—6 INCH LENS—35 mm. CAMERAS

Point of Focus	F.2.8	F.3.2	F.4	F.4.5	F.5.6	F.6.3
	IN FOCUS FROM					
Feet	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.
8	7 10 to 8 1	7 9 to 8 2	7 9 to 8 2	7 9 to 8 3	7 9 to 8 3	7 8 to 8 3
9	8 10 to 9 1	8 9 to 9 2	8 8 to 9 2	8 8 to 9 3	8 8 to 9 3	8 7 to 9 4
10	9 9 to 10 2	9 8 to 10 3	9 8 to 10 3	9 7 to 10 4	9 7 to 10 4	9 7 to 10 5
12	11 8 to 12 3	11 7 to 12 4	11 7 to 12 4	11 6 to 12 5	11 5 to 12 6	11 4 to 12 7
14	13 9 to 14 4	13 6 to 14 6	13 4 to 14 8	13 3 to 14 9	13 3 to 14 9	13 2 to 14 11
16	15 6 to 16 6	15 4 to 16 7	15 3 to 16 8	15 1 to 16 10	15 to 17	14 11 to 17 2
18	17 4 to 18 7	17 2 to 18 9	17 1 to 18 11	16 11 to 19 2	16 9 to 19 4	16 8 to 19 6
20	19 3 to 20 9	19 1 to 20 11	18 11 to 21	18 8 to 21 4	18 6 to 21 7	18 4 to 21 10
25	23 10 to 26 2	23 8 to 26 6	23 6 to 26 10	23 2 to 27 2	22 10 to 27 7	22 6 to 28
30	28 4 to 31 9	28 to 32 3	27 8 to 32 8	27 3 to 33 4	26 10 to 33 10	26 6 to 34 5
35	32 9 to 37 6	32 3 to 38 2	31 11 to 38 8	31 5 to 39 7	30 10 to 40 5	30 4 to 41 2
40	38 6 to 45	37 3 to 44 11	36 to 44 10	35 4 to 46	34 8 to 47 2	34 1 to 49 4
45	41 5 to 49 2	40 8 to 50 2	40 to 51 3	39 2 to 52 8	38 4 to 54 4	37 8 to 55 9
50	45 7 to 55 5	45 2 to 56	44 10 to 56 5	42 5 to 59 3	41 10 to 61 10	41 to 63 8
60	53 9 to 67 9	52 8 to 69 9	51 6 to 71 9	50 3 to 74 8	48 9 to 77 10	47 8 to 80 11
75	65 6 to 87 7	63 9 to 91	62 2 to 94 4	60 to 100 5	58 3 to 105 2	56 8 to 110 9
100	83 11 to 123 8	80 8 to 130 6	78 5 to 137 8	75 5 to 149 3	72 3 to 162	69 10 to 175 9
125	100 10 to 164 4	96 6 to 177 2	93 to 190	90 1 to 216	86 8 to 240	81 2 to 271
150	116 6 to 210 5	111 2 to 232 4	106 3 to 254 8	101 4 to 303 8	95 3 to 352 8	91 .1 to 424 4
175	129 2 to 263 3	124 4 to 300 8	118 3 to 336 2	111 8 to 434 6	104 9 to 531	100 6 to 712 3
200	144 6 to 324 2	136 6 to 333 6	129 2 to 442 5	121 2 to 663 2	113 2 to 885 8	105 9 to Inf.
250	168 2 to 514 8	156 6 to 539 2	147 6 to 566 8	133 8 to 762	126 to Inf.	117 8 to Inf.
300	190 5 to 705	179 9 to 788 4	164 8 to Inf.	146 to Inf.	139 6 to Inf.	130 9 to Inf.

*Depth of Field

Calculated at 1/500 inch Circle of Confusion.

DEPTH OF FOCUS*

150 mm—6 INCH LENS—35 mm. CAMERAS

Point of Focus	F.8				F.9.1				F.11				F.12.5				F.16				F.22			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
8	7	7 to	8	4	7	7 to	8	5	7	6 to	8	6	7	5 to	8	8	7	4 to	8	9	7	2 to	9	0
9	8	6 to	9	5	8	6 to	9	6	8	5 to	9	7	8	3 to	9	9	8	2 to	9	11	7	6 to	10	5
10	9	6 to	10	7	9	4 to	10	8	9	3 to	10	9	9	1 to	10	11	9	0 to	11	2	8	9 to	11	8
12	11	3 to	12	10	11	1 to	12	11	11	to	13	2	10	10 to	13	6	10	7 to	13	9	10	1 to	14	4
14	13	to	15	2	12	10 to	15	4	12	7 to	15	7	12	4 to	16		12	1 to	16	6	11	7 to	17	7
16	14	8 to	17	6	14	6 to	17	11	14	3 to	18	2	14	to	18	8	13	8 to	19	4	12	11 to	20	10
18	16	4 to	19	11	16	2 to	20	3	15	10 to	20	10	15	5 to	21	7	15	to	22	5	14	3 to	24	6
20	18	to	22	5	17	9 to	22	10	17	4 to	23	6	16	10 to	24	6	16	4 to	25	7	15	5 to	28	5
25	21	11 to	28	11	21	7 to	29	7	21	to	30	10	20	4 to	32	6	19	7 to	34	8	18	3 to	39	9
30	25	9 to	35	11	25	3 to	36	11	24	5 to	38	9	23	5 to	41	8	22	6 to	44	9	20	9 to	50	4
35	29	4 to	43	4	28	4 to	44	9	27	7 to	47	7	26	1 to	52	3	25	3 to	56	10	23	to	73	4
40	32	9 to	50	9	32	to	53	4	30	8 to	57	4	28	10 to	64	4	27	9 to	71	4	25	0 to	99	7
45	36	to	59	9	35	1 to	62	7	33	6 to	68	3	32	6 to	73		30	1 to	89		26	10 to	138	2
50	39	2 to	68	10	38	1 to	72	8	36	3 to	80	5	34	3 to	87	2	32	3 to	94		28	7 to	200	
60	45	to	89	6	43	7 to	96		41	3 to	110		38	7 to	140	6	36	1 to	176	1	31	7 to	609	3
75	53	to	127	6	51	to	141	2	47	9 to	173	8	45	4 to	298	4	41	1 to	426	6	35	4 to	Inf.	
100	64	6 to	222		61	6 to	266	8	56	10 to	412	6	52	3 to	704	6	47	7 to	Inf.		39	10 to	Inf.	
125	74	2 to	399	2	67	8 to	571	5	64	2 to	Inf.		58	3 to	Inf.		52	4 to	Inf.		43	4 to	Inf.	
150	82	2 to	853	1	77	5 to	Inf.		70	2 to	Inf.		63	4 to	Inf.		55	7 to	Inf.		45	11 to	Inf.	
175	89	2 to	Inf.		83	6 to	Inf.		75	2 to	Inf.		67	6 to	Inf.		59	10 to	Inf.		48	0 to	Inf.	
200	94	1 to	Inf.		88	10 to	Inf.		79	6 to	Inf.		71	1 to	Inf.		62	6 to	Inf.		49	8 to	Inf.	
250	105	4 to	Inf.		96	6 to	Inf.		85	4 to	Inf.		76	4 to	Inf.		66	9 to	Inf.		52	3 to	Inf.	
300	113	3 to	Inf.		104	4 to	Inf.		91	8 to	Inf.		80	9 to	Inf.		69	9 to	Inf.		54	2 to	Inf.	

*Depth of Field.

Calculated at 1/500 inch Circle of Confusion.

PROJECTION CHART FOR MINIATURE CAMERA SLIDES

SIZE OF PICTURE
OBTAINED WITH VARIOUS LENSES

DISTANCE FROM LENS TO SCREEN

		6 FEET		8 FEET		10 FEET		12 FEET		15 FEET		20 FEET	
		SIZE OF PICTURE											
LENS SIZE M.M.		Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
35	W	6	0	8	1	10	4	12	1	15	6	20	8
	H	4	0	5	4	6	9	8	1	10	2	13	7
40	W	5	3	7	1	8	10	10	7	13	3	17	9
	H	3	6	4	8	5	11	7	8	8	11	11	10
50	W	4	2	5	7	7	0	8	5	10	6	14	1
	H	2	9	3	9	4	8	5	7	7	1	9	5
75	W	2	9	3	8	4	8	5	6	7	0	9	4
	H	1	10	2	5	3	1	3	8	4	8	6	2
85	W	2	5	3	3	4	1	4	10	6	2	8	2
	H	1	7	2	2	2	8	3	2	4	1	5	5
105	W	1	11	2	7	3	5	3	10	5	2	6	11
	H	1	3	1	9	2	2	2	7	3	3	4	5
120	W	1	8	2	3	2	10	3	4	4	3	5	9
	H	1	1	1	6	1	11	2	3	2	10	3	10
135	W	1	5	2	0	2	6	2	11	3	9	5	1
	H	1	0	1	4	1	8	2	0	2	6	3	5
150	W	1	3	1	9	2	3	2	7	3	5	4	6
	H		10	1	2	1	6	1	9	2	3	3	0
165	W	1	2	1	7	2	0	2	4	3	1	4	1
	H		9	1	1	1	4	1	7	2	0	2	9
180	W	1	1	1	5	1	10	2	2	2	9	3	9
	H		8	1	0	1	3	1	5	1	10	2	6
200	W		11	1	3	1	8	1	11	2	6	3	4
	H		7		10	1	1	1	3	1	8	2	3

Based on Miniature Camera Size 24 mm.x36 mm.

PROJECTION CHART FOR MINIATURE CAMERA SLIDES

SIZE OF PICTURE
OBTAINED WITH VARIOUS LENSES

DISTANCE FROM LENS TO SCREEN

		25 FEET		30 FEET		40 FEET		50 FEET		60 FEET		75 FEET	
		SIZE OF PICTURE											
LENS SIZE M.M.		Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
35	W	25	10	31	0	41	4	51	9	60	7	77	8
	H	17	0	20	5	27	3	34	1	40	6	51	3
40	W	22	3	26	7	35	6	44	6	52	11	66	10
	H	14	10	17	0	23	9	28	0	35	4	44	7
50	W	17	8	21	1	28	2	35	4	42	1	53	1
	H	11	10	14	2	18	11	23	8	27	11	35	7
75	W	11	8	14	0	18	9	23	6	27	8	35	2
	H	7	9	9	4	12	5	15	7	18	4	23	5
85	W	10	3	12	4	16	5	20	7	24	2	30	11
	H	6	10	8	3	11	0	13	9	16	2	20	8
105	W	8	8	10	5	13	11	17	4	19	5	26	0
	H	5	6	6	7	8	10	11	0	12	11	1	67
120	W	7	2	8	7	11	6	14	4	16	8	21	7
	H	4	9	5	9	7	8	9	7	11	3	14	5
135	W	6	4	7	7	10	2	12	9	14	9	19	2
	H	4	3	5	1	6	9	8	6	10	2	12	9
150	W	5	8	6	10	9	1	11	4	13	2	17	1
	H	3	9	4	7	6	1	7	7	8	10	11	5
165	W	5	1	6	2	8	3	10	3	11	11	15	4
	H	3	5	4	1	5	6	6	10	7	11	10	4
180	W	4	9	5	7	7	6	9	7	10	10	14	5
	H	3	1	3	9	5	0	6	3	7	2	9	5
200	W	4	2	5	0	6	8	8	5	9	8	12	8
	H	2	9	3	4	4	6	5	7	6	5	8	5

Based on Miniature Camera Size 24mm.x36mm.

PROJECTION CHART FOR STEREOPTICAN SLIDES

SIZE OF PICTURE
OBTAINED WITH VARIOUS LENSES
DISTANCE FROM LENS TO SCREEN

LENS SIZE IN.		10 FEET Ft.	10 FEET In.	15 FEET Ft.	15 FEET In.	20 FEET Ft.	20 FEET In.	25 FEET Ft.	25 FEET In.	30 FEET Ft.	30 FEET In.	40 FEET Ft.	40 FEET In.
4	W	9	1	13	9	18	5	23	1	27	9	37	2
	H	7	3	11	0	14	9	18	6	22	3	28	1
5	W	7	3	10	11	14	8	18	6	22	3	28	1
	H	5	9	8	9	11	9	14	9	17	9	23	9
6	W	5	11	9	1	12	2	15	3	18	5	24	8
	H	4	9	7	3	9	9	12	3	14	9	18	1
7	W	5	0	7	9	10	4	13	1	15	9	21	1
	H	4	0	6	2	8	4	10	5	12	7	16	11
8	W	4	4	6	8	9	1	11	5	13	9	18	5
	H	3	6	5	5	7	3	9	2	11	0	14	9
10	W	3	5	5	4	8	0	9	1	10	11	16	8
	H	2	9	4	3	5	9	7	3	8	9	11	9
12	W	2	9	4	4	5	11	7	6	9	1	12	2
	H	2	3	3	6	4	9	6	0	7	3	9	9
14	W	2	4	3	8	5	0	6	4	7	9	10	5
	H	1	10	3	0	4	0	5	1	6	2	8	4
16	W	2	0	3	2	4	4	5	6	6	9	9	1
	H	1	7	2	7	3	6	4	5	5	4	7	3
18	W	1	9	2	10	3	10	4	10	5	11	8	0
	H	1	5	2	3	3	1	3	11	4	9	6	5
20	W	1	6	2	6	3	5	4	4	5	4	7	2
	H	1	3	2	0	2	9	3	6	4	3	5	9

Based on Standard Lantern Slide size 3¼x4
with Matte Opening of 3x3¾

PROJECTION CHART FOR STEREOPTICAN SLIDES

SIZE OF PICTURE

OBTAINED WITH VARIOUS LENSES
DISTANCE FROM LENS TO SCREEN .

LENS SIZE IN.		50 FEET Ft.	50 FEET In.	60 FEET Ft.	60 FEET In.	70 FEET Ft.	70 FEET In.	80 FEET Ft.	80 FEET In.	90 FEET Ft.	90 FEET In.	100 FEET Ft.	100 FEET In
4	W	46	6	56	0	65	2	74	10	84	2	93	4
	H	37	3	44	9	52	4	59	4	67	2	83	0
5	W	37	2	44	9	52	2	59	4	67	3	82	11
	H	28	1	35	9	41	9	47	10	54	0	59	9
6	W	36	11	37	3	43	6	49	9	55	11	62	0
	H	24	9	29	9	34	10	39	8	45	0	49	9
7	W	26	5	31	10	37	2	42	6	47	11	53	2
	H	21	2	25	5	29	9	34	0	38	6	42	8
8	W	23	1	27	9	32	5	37	1	42	0	46	5
	H	18	6	22	3	26	0	29	8	33	6	37	2
10	W	18	5	22	2	25	11	29	8	33	5	37	2
	H	14	9	17	9	20	0	23	9	26	10	29	9
12	W	15	3	18	5	21	7	24	8	27	10	30	11
	H	12	3	14	9	18	0	19	9	22	3	24	9
14	W	13	1	15	9	18	5	21	1	23	10	26	5
	H	10	6	12	7	14	9	16	11	19	1	21	2
16	W	11	5	13	9	16	1	18	6	20	10	23	1
	H	9	1	11	0	12	10	14	9	16	8	18	6
18	W	10	1	12	2	14	3	16	4	18	5	20	6
	H	8	1	9	9	11	5	31	1	14	9	16	5
20	W	9	1	10	11	12	10	14	8	16	7	18	5
	H	7	3	8	9	10	3	11	9	13	3	14	9

Based on Standard Lantern Slide Size 3¼x4
with Matte Opening of 3x3¾

PROJECTION CHART FOR PROCESS BACKGROUND

SIZE OF PICTURE
OBTAINED WITH VARIOUS LENSES

DISTANCE FROM LENS TO SCREEN

LENS SIZE IN.		20 FEET Ft.	20 FEET In.	25 FEET Ft.	25 FEET In.	30 FEET Ft.	30 FEET In.	40 FEET Ft.	40 FEET In.	50 FEET Ft.	50 FEET In.	60 FEET Ft.	60 FEET In.
3	W	6	0	7	6	9	1	12	1	15	0	18	1
	H	4	5	5	7	6	8	9	0	11	4	13	6
4	W	4	5	5	8	6	8	9	0	11	3	13	6
	H	3	4	4	4	5	1	6	8	8	5	10	1
4½	W	4	1	5	1	6	0	8	1	10	1	12	1
	H	3	1	3	9	4	5	6	1	7	7	9	2
5	W	3	6	4	6	5	4	7	3	9	1	10	9
	H	2	7	3	5	4	1	5	5	6	8	8	2
5½	W	3	3	4	2	4	9	6	7	8	2	9	9
	H	2	6	3	2	3	7	5	1	6	1	7	5
6	W	3	0	3	8	4	5	6	1	7	5	9	1
	H	2	3	2	9	3	4	4	7	5	6	6	8
6½	W	2	8	3	6	4	3	5	6	6	9	8	4
	H	2	1	2	7	3	3	4	2	5	3	6	2
7	W	2	6	3	3	3	9	5	2	6	4	7	1
	H	1	9	2	5	2	9	3	9	4	9	5	4
8	W			2	9	3	4	4	5	5	6	6	8
	H			2	2	2	6	3	4	4	3	5	1
9	W					3	3	4	1	5	0	6	0
	H					3	0	3	1	3	9	4	5

Based on Projection Aperture .906x.679.

PROJECTION CHART FOR PROCESS BACKGROUNDS

SIZE OF PICTURE
OBTAINED WITH VARIOUS LENSES

DISTANCE FROM LENS TO SCREEN

LENS SIZE IN.		70 FEET Ft.	70 FEET In.	80 FEET Ft.	80 FEET In.	90 FEET Ft.	90 FEET In.	100 FEET Ft.	100 FEET In.	110 FEET Ft.	110 FEET In.	120 FEET Ft.	120 FEET In.
		SIZE OF PICTURE											
3	W.	21	1	24	2	27	2	30	1	33	1	36	3
	H.	15	8	18	1	20	3	22	7	24	8	27	2
4	W.	15	7	18	1	20	2	22	6	24	7	27	3
	H.	11	9	13	6	15	1	16	9	18	7	20	4
4½	W.	14	1	16	2	18	1	20	1	22	0	24	1
	H.	10	7	12	2	13	6	15	2	16	7	18	3
5	W.	12	7	14	5	16	3	18	3	19	7	21	6
	H.	9	5	10	8	12	1	13	4	14	8	16	4
5½	W.	11	5	13	2	14	7	16	4	18	2	19	6
	H.	8	4	9	9	11	2	12	3	13	7	14	9
6	W.	10	4	12	2	13	4	15	2	16	6	18	2
	H.	7	8	9	1	10	2	11	4	12	5	13	4
6½	W.	10	1	11	2	12	6	13	9	15	4	16	6
	H.	7	6	8	2	9	5	10	4	11	4	12	6
7	W.	9	1	10	2	11	5	12	9	14	3	15	5
	H.	6	8	7	6	8	8	9	7	10	7	11	6
8	W.	7	9	9	1	10	1	11	2	12	3	13	5
	H.	5	9	6	8	7	7	8	4	9	4	10	2
9	W.	7	0	8	1	9	1	10	1	11	2	12	1
	H.	5	3	6	1	6	8	7	6	8	3	9	1

Based on Projection Aperture .906 X 679

PROJECTION CHART FOR PROCESS BACKGROUND

SIZE OF PICTURE
OBTAINED WITH VARIOUS LENSES

DISTANCE FROM LENS TO SCREEN

		130 FEET		140 FEET		150 FEET		160 FEET		170 FEET		180 FEET	
		SIZE OF PICTURE											
LENS SIZE IN.		Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	W.	39	2	42	3	45	2	48	4	52	2	56	6
	H.	29	5	31	8	33	8	35	9	38	3	42	2
4	W.	29	4	31	6	33	9	36	3	38	6	40	8
	H.	22	1	23	7	25	4	27	1	28	6	31	0
4½	W.	26	2	23	8	30	3	32	2	34	3	36	0
	H.	19	7	21	1	22	5	24	0	25	7	27	2
5	W.	23	4	25	5	27	2	28	6	30	6	32	5
	H.	17	5	19	1	20	2	21	8	23	4	24	4
5½	W.	21	4	23	2	24	6	26	3	27	8	29	8
	H.	16	2	17	2	18	6	19	8	20	6	22	4
6	W.	19	4	21	1	22	6	24	2	25	6	27	1
	H.	14	8	15	9	16	8	18	2	19	3	20	4
6½	W.	18	2	19	4	20	6	22	4	23	6	25	2
	H.	13	6	14	6	15	8	16	4	17	8	18	8
7	W.	16	8	18	4	19	6	20	6	21	8	23	2
	H.	12	8	13	2	14	6	15	4	16	4	17	4
8	W.	14	6	15	8	16	8	18	1	19	2	20	3
	H.	11	2	11	7	12	8	13	5	14	2	15	2
9	W.	13	1	14	2	15	2	16	1	17	2	18	0
	H.	9	9	10	6	11	4	12	0	12	8	13	6

Based on Projection Aperture .906 x .679

PROJECTION CHART FOR 35 mm. SOUND FILM

SIZE OF PICTURE
OBTAINED WITH VARIOUS LENSES
DISTANCE FROM LENS TO SCREEN

		20 FEET		25 FEET		30 FEET		35 FEET		40 FEET		50 FEET	
		SIZE OF PICTURE											
LENS SIZE IN.		Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
2	W	8	2	10	2	12	3	14	4	16	4	20	5
	H	5	9	7	5	8	9	10	4	11	9	14	9
2½	W	6	7	8	2	9	8	11	4	13	1	16	4
	H	4	9	5	9	7	1	8	3	9	5	11	9
3	W	5	5	6	9	8	2	9	6	10	9	13	6
	H	3	9	4	9	5	9	6	9	7	9	9	9
3½	W	4	8	5	9	7	0	8	2	9	4	11	7
	H	3	5	4	2	5	1	5	9	6	9	8	5
4	W	4	1	5	1	6	2	7	1	8	2	10	3
	H	2	9	3	8	4	4	5	2	5	9	7	5
4½	W	3	7	4	7	5	5	6	4	7	3	9	1
	H	2	7	3	3	3	9	4	7	5	3	6	7
5	W	3	3	4	1	4	9	5	8	6	7	8	2
	H	2	4	2	9	3	7	4	1	4	8	5	9
5½	W			3	8	4	6	5	2	5	9	7	5
	H			2	8	3	4	3	8	4	3	5	4
6	W					4	1	4	6	5	4	6	9
	H					2	9	3	4	3	9	4	9
7	W							4	1	4	8	5	9
	H							2	9	3	4	4	3
8	W									4	1	5	2
	H									2	9	3	8

Standard Sound Aperture .825x.600

PROJECTION CHART FOR 35 mm. SOUND FILM

SIZE OF PICTURE
OBTAINED WITH VARIOUS LENSES

DISTANCE FROM LENS TO SCREEN

		60 FEET		70 FEET		80 FEET		90 FEET		100 FEET		110 FEET	
		SIZE OF PICTURE											
LENS SIZE IN.		Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
2	W	24	6	28	6	32	9	37	0	41	1	45	2
	H	17	9	29	0	24	0	27	0	30	0	33	0
2½	W	19	7	23	0	26	3	29	6	32	9	36	2
	H	14	4	16	7	19	1	21	5	23	9	26	4
3	W	16	4	19	1	21	9	24	6	27	4	30	2
	H	11	8	13	9	15	8	17	9	19	8	21	8
3½	W	14	1	16	4	18	0	21	2	23	5	25	9
	H	10	2	11	9	13	6	15	4	17	0	18	8
4	W	12	3	14	3	16	4	18	5	20	6	22	6
	H	8	8	10	4	11	9	13	4	14	9	16	4
4½	W	10	9	12	7	14	6	16	4	18	3	20	2
	H	7	9	9	2	10	6	11	9	13	3	14	6
5	W	9	9	11	4	13	1	14	8	16	4	18	1
	H	7	2	8	3	9	5	10	7	11	9	13	1
5½	W	8	9	10	5	11	9	13	4	14	9	16	4
	H	6	6	7	7	8	6	9	7	10	8	11	9
6	W	8	2	9	0	10	9	12	3	13	6	15	0
	H	5	9	6	9	7	9	8	9	9	9	10	9
7	W	7	0	8	2	9	4	10	5	11	7	12	9
	H	5	1	5	9	6	9	7	5	8	5	9	3
8	W	6	1	7	1	8	2	9	4	10	2	11	2
	H	4	4	5	2	5	9	6	8	7	4	8	1

• Standard Sound Aperture .825x.600

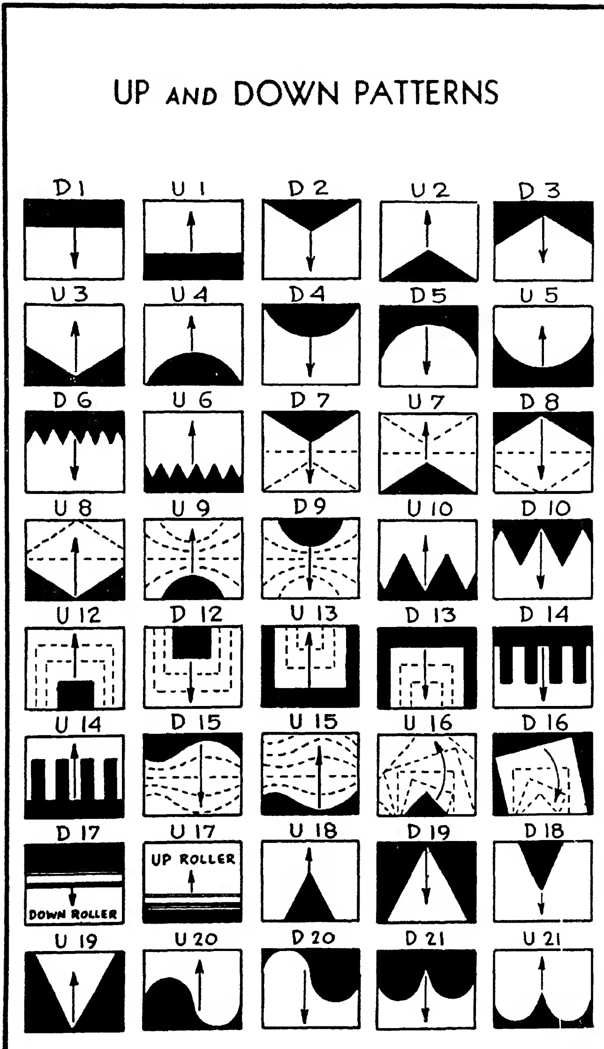
PROJECTION CHART FOR 35 mm. SOUND FILM

SIZE OF PICTURE
OBTAINED WITH VARIOUS LENSES

DISTANCE FROM LENS TO SCREEN

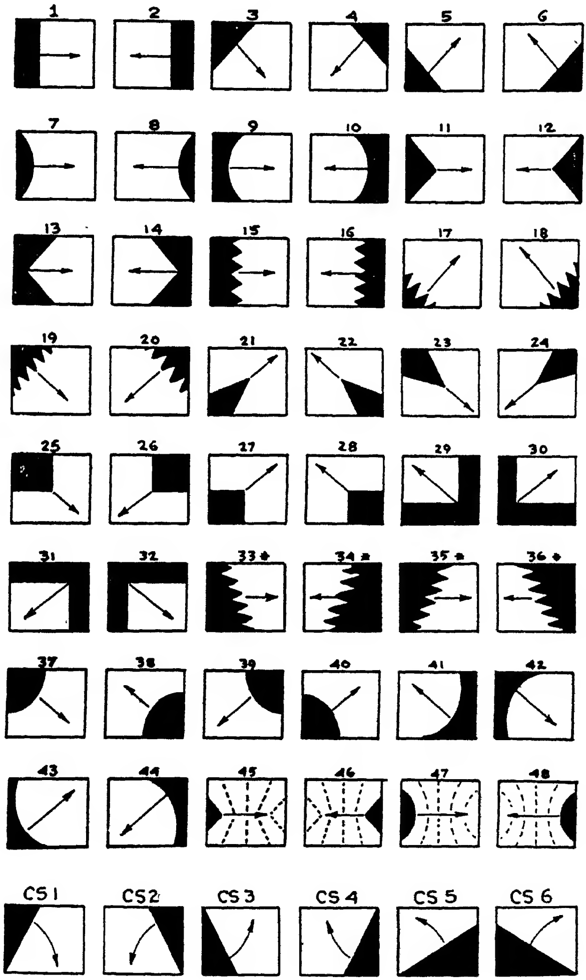
LENS SIZE IN.		120 FEET Ft.	120 FEET In.	130 FEET Ft.	130 FEET In.	140 FEET Ft.	140 FEET In.	150 FEET Ft.	150 FEET In.	160 FEET Ft.	160 FEET In.	170 FEET Ft.	170 FEET In.
2	W	49	0	53	2	57	2	61	2	65	6	70	2
	H	35	6	38	9	41	6	44	8	47	6	50	8
2½	W	39	5	42	6	46	1	49	0	52	4	56	0
	H	28	7	31	1	33	6	35	6	38	2	40	6
3	W	32	9	35	6	38	4	40	9	43	9	46	6
	H	23	8	25	8	27	8	29	8	31	8	33	6
3½	W	28	2	30	4	32	9	35	2	37	6	40	0
	H	20	9	22	2	23	9	25	6	27	3	29	0
4	W	24	6	26	7	28	7	30	7	32	9	35	1
	H	17	9	19	5	20	9	22	4	23	9	25	4
4½	W	21	9	23	7	25	5	27	3	29	2	31	2
	H	15	9	17	2	18	6	19	9	21	2	22	6
5	W	19	7	21	3	23	0	24	6	26	2	28	0
	H	14	3	15	5	16	7	17	9	19	1	20	3
5½	W	17	9	19	4	20	9	22	3	23	9	25	4
	H	13	0	14	1	15	2	16	3	17	4	18	5
6	W	16	4	17	8	19	1	20	5	21	8	23	3
	H	11	9	12	9	13	9	14	9	15	9	16	9
7	W	14	0	15	2	16	4	17	5	18	8	20	1
	H	10	2	11	1	11	9	12	7	13	6	14	5
8	W	12	3	13	3	14	3	15	3	16	4	17	4
	H	8	9	9	7	10	4	11	2	11	9	12	7

Standard Sound Aperture .825x.600

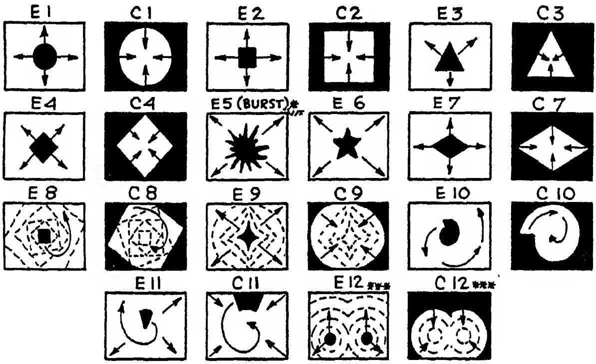


Courtesy of J. A. Norling
Loucks & Norling Studios, New York

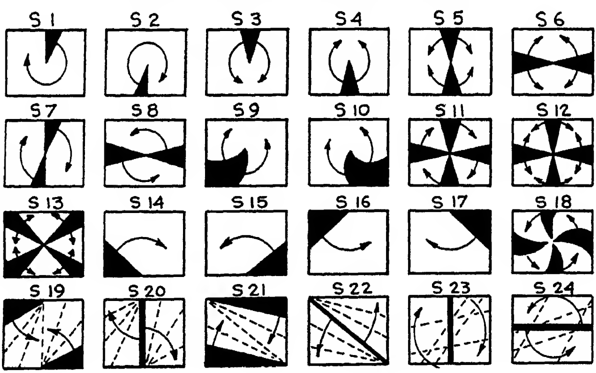
STRAIGHT ACROSS AND DIAGONAL PATTERNS



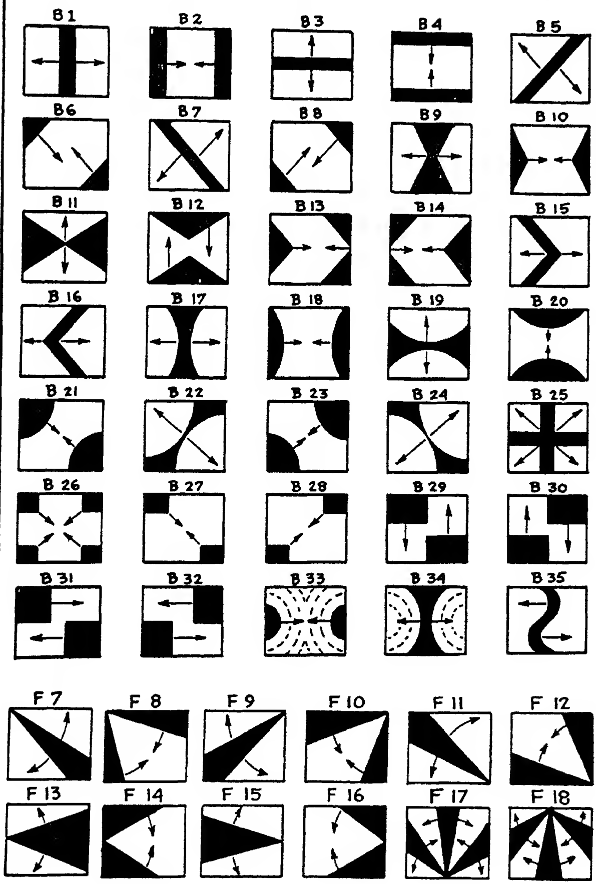
EXPANDING AND CONTRACTING PATTERNS



SWING AND SPIN PATTERNS



HORIZONTAL, VERTICAL AND DIAGONAL "BARNDOORS": SPLIT, EXPANDING AND CONTRACTING PATTERNS



SHUTTER COMPENSATOR

SHUTTER OPENING FOR VARIOUS CAMERA SPEEDS

PICTURES PER SECOND									
6		8		10		12		14	
CAMERA SPEED	SHUTTER OPENING	CAMERA SPEED	SHUTTER OPENING	CAMERA SPEED	SHUTTER OPENING	CAMERA SPEED	SHUTTER OPENING	CAMERA SPEED	SHUTTER OPENING
6 =	170°	8 =	170°	10 =	170°	12 =	170°	14 =	170°
5 =	142°	7 =	148°	9 =	153°	11 =	154°	13 =	168°
4 =	123°	6 =	128°	8 =	136°	10 =	140°	12 =	145°
3 =	85°	5 =	106°	7 =	119°	9 =	126°	11 =	133°
2 =	57°	4 =	85°	6 =	102°	8 =	113°	10 =	121°
1 =	28°	3 =	64°	5 =	85°	7 =	98°	9 =	119°
		2 =	42°	4 =	68°	6 =	85°	8 =	97°
		1 =	21°	3 =	51°	5 =	70°	7 =	85°
				2 =	34°	4 =	57°	6 =	73°
				1 =	17°	3 =	42°	5 =	61°
						2 =	28°	4 =	49°
								3 =	36°
								2 =	24°

LENS DIAPHRAGM OPENING CONSTANT

SHUTTER COMPENSATOR

SHUTTER OPENING FOR VARIOUS CAMERA SPEEDS

PICTURES PER SECOND				
16	18	20	22	24
CAMERA SPEED / SHUTTER OPENING	CAMERA SPEED / SHUTTER OPENING	CAMERA SPEED / SHUTTER OPENING	CAMERA SPEED / SHUTTER OPENING	CAMERA SPEED / SHUTTER OPENING
16 = 170°	18 = 170°	20 = 170°	22 = 170°	24 = 170°
14 = 148°	16 = 152°	18 = 153°	20 = 156°	22 = 156°
12 = 126°	14 = 133°	16 = 136°	18 = 140°	20 = 142°
10 = 106°	12 = 114°	14 = 119°	16 = 124°	18 = 130°
8 = 85°	10 = 95°	12 = 102°	14 = 108°	16 = 120°
6 = 64°	8 = 76°	10 = 85°	12 = 93°	14 = 100°
4 = 42°	6 = 57°	8 = 68°	10 = 78°	12 = 85°
2 = 21°	4 = 38°	6 = 51°	8 = 62°	10 = 72°
1 = 11°	2 = 19°	4 = 34°	6 = 46°	8 = 56°
	1 = 9°	2 = 17°	4 = 30°	6 = 42°
		1 = 8°	2 = 15°	4 = 28°
			1 = 8°	2 = 14°
				1 = 7°

LENS DIAPHRAGM OPENING CONSTANT

SHUTTER COMPENSATOR

SHUTTER OPENING FOR VARIOUS CAMERA SPEEDS WITH SPECIAL AND AKELEY CAMERAS

PICTURES PER SECOND									
24		20		18		16		12	
CAMERA SPEED	SHUTTER OPENING	CAMERA SPEED	SHUTTER OPENING	CAMERA SPEED	SHUTTER OPENING	CAMERA SPEED	SHUTTER OPENING	CAMERA SPEED	SHUTTER OPENING
24 =	230°	20 =	230°	18 =	230°	16 =	230°	12 =	230°
22 =	210°	18 =	206°	16 =	208°	14 =	200°	10 =	190°
20 =	190°	16 =	184°	14 =	182°	12 =	174°	8 =	150°
18 =	172°	14 =	160°	12 =	156°	10 =	140°	6 =	115°
16 =	152°	12 =	138°	10 =	130°	8 =	115°	4 =	76°
14 =	132°	10 =	115°	8 =	104°	6 =	88°	2 =	38°
12 =	115°	8 =	92°	6 =	78°	4 =	58°		
10 =	95°	6 =	70°	4 =	52°	2 =	29°		
8 =	76°	4 =	46°	2 =	26°				
6 =	57°	2 =	23°						
4 =	38°								
2 =	19°								

LENS DIAPHRAGM OPENING CONSTANT

CAMERA SPEED CONVERSION
TO AUTOMOBILE VELOCITY

CAMERA OPERATING SPEED

24	22	20	18	16	14	12	10	8	6
PICTURES PER SECOND									
Auto Speed Miles Per Hour	AUTO SPEED IN MILES PER HOUR CONVERTED BY CAMERA SPEEDS ABOVE								
2			3			4	5	6	8
4		5	6	7	7	8	10	12	16
6	7	8	9	10	11	12	15	18	24
8	9	10	12	14	15	16	20	24	32
10	11	12	15	17	18	20	25	30	40
12	13	15	18	21	22	24	30	36	48
15	16	18	22	25	27	30	37	45	60
20	22	25	30	35	37	40	50	60	80
25	28	31	37	43	47	50	62	75	100
30	34	37	45	52	56	60	75	90	120
35	39	43	52	59	65	70	87	105	140
40	45	50	60	70	75	80	100	120	160
45	51	56	72	79	85	90	113	135	180
50	56	62	75	87	94	100	125	150	200
55	62	69	82	96	103	110	137	165	220
60	67	75	90	105	112	120	150	180	240

To make auto appear running 60 miles per hour, reduce camera speed as shown under CAMERA OPERATING SPEED and at right angle to first column.

EXAMPLE: 60 miles per hour can be had by auto speed of 30 miles per hour and camera operation of 12 pictures per second.

DIAPHRAGM COMPENSATOR

Lens Stop Conversion for
Various Camera Speeds

BELOW NORMAL

Pictures per Second

24	20	18	16	14	12	10	8	6
F. Value Normal Speed	LENS STOPS COMPENSATED FOR SPEEDS ABOVE							
1.8	2.	2.1	2.2	2.4	2.6	2.8	3.	3.2
2.	2.2	2.3	2.4	2.6	2.8	3.1	3.5	4.
2.3	2.6	2.7	2.9	3.	3.2	3.5	4.	4.5
2.8	3.1	3.2	3.5	3.8	4.	4.5	5.	5.6
3.2	3.8	4.	4.2	4.4	4.5	5.2	5.8	6.3
4.	4.3	4.5	4.8	5.2	5.6	6.2	7.	8.
4.5	5.2	5.6	5.8	6.	6.3	7.1	8.	9.1
5.6	6.1	6.3	6.8	7.3	8.	9.	10.	11.3
6.3	7.3	8.	8.3	8.6	9.1	10.1	11.2	12.5
8.	8.7	9.1	9.8	10.4	11.3	12.5	14.	16.
9.1	10.7	11.3	11.7	12.1	12.5	14.2	16.	18.
11.3	12.	12.5	13.6	14.8	16.	18.	20.	22.
12.5	14.5	16.	16.7	17.4	18.	20.	22.	25.
16.	17.3	18.	19.4	20.6	22.	25.	29.	32.
18.	21.	22.	22.9	24.	25.	29.	33.	36.
22.	24.	25.	28.	30.	32.	36.	40.	45.
25.	30.	32.	33.	34.	36.	40.	45.	
32.	34.	36.	39.	42.	45.			

SHUTTER OPENING CONSTANT

DIAPHRAGM COMPENSATOR

Lens Stop Conversion for Various Camera Speeds

ABOVE NORMAL

Pictures per Second

24	28	32	36	40	44	48	72	96
F. Value Normal Speed	LENS STOPS COMPENSATED FOR SPEEDS ABOVE							
F. 2.3	2.2	2.1	2.					
2.8	2.6	2.4	2.3	2.2	2.1	2.		
3.2	3.	2.9	2.8	2.6	2.4	2.3	2.	
4.	3.7	3.5	3.2	3.	2.9	2.8	2.3	2.
4.5	4.3	4.1	4.	3.7	3.5	3.2	2.8	2.3
5.6	5.2	4.8	4.5	4.3	4.1	4.	3.2	2.8
6.3	6.	5.8	5.6	5.2	4.8	4.5	4.	3.2
8.	7.4	6.8	6.3	6.	5.8	5.6	4.5	4.
9.1	8.7	8.3	8.	7.4	6.8	6.3	5.6	4.5
11.3	10.5	9.8	9.1	8.7	8.3	8.	6.3	5.6
12.5	12.1	11.7	11.3	10.5	9.8	9.1	8.	6.3
16.	14.8	13.7	12.5	12.1	11.7	11.3	9.1	8.
18.	17.3	16.7	16.	14.8	13.7	12.5	11.3	9.1
22.	20.7	19.3	18.	17.3	16.7	16.	12.5	11.3
25.	24.	23.	22.	20.7	19.3	18.	16.	12.5
32.	30.	27.	25.	24.	23.	22.	18.	16.
36.	34.	33.	32.	30.	27.	25.	22.	18.

SHUTTER OPENING CONSTANT

EXPOSURE EQUALIZER
FOR VARIOUS SHUTTER OPENINGS

SHUTTER OPENING								
170°	150°	135°	120°	90°	60°	40°	20°	10°
EQUALIZED EXPOSURE IN F. VALUES								
F.	F.	F.	F.					
2.3	2.1	2	1.9					
2.8	2.6	2.5	2.4	2.0				
3.2	3	2.8	2.7	2.3	1.9			
4	3.7	3.5	3.4	2.9	2.4	1.9		
4.5	4.2	4	3.8	3.3	2.7	2.2		
5.6	5.3	5	4.7	4.1	3.3	2.7	1.9	
6.3	5.9	5.6	5.3	4.6	3.7	3.1	2.2	
8	7.5	7	6.7	5.8	4.7	3.9	2.7	1.9
9.1	8.5	8	7.7	6.7	5.5	4.5	3.2	2.3
11.3	10.6	10	9.6	8.3	6.8	5.6	4	2.8
12.5	11.7	11	10.5	9.1	7.4	6.1	4.3	3.1
16	15	14	13.5	11.6	9.5	7.8	5.5	3.9
18	16.9	16	15.1	13.1	10.7	8.7	6.2	4.4
22	20.3	19	18.5	16	13.1	10.7	7.5	5.4
25	23.5	22	21	18.2	14.9	12.1	8.6	6.1
32	30	28	27	23.2	19	15.5	11	8

NOTE:—Column on left indicates normal exposure with 170 degree shutter exposure. For other shutter openings read F. value in column showing shutter opening and opposite normal F. value cross column. EXAMPLE: F.11.3 at 170 degree is equivalent to F.6.8 at 60.

CAMERA SPEED CONSTANT

EXPOSURE EQUALIZER

FOR CAMERAS OF VARIOUS LARGER SHUTTER OPENINGS

SHUTTER OPENING					
170°	200°	230°	250°	265°	280°
EQUALIZED EXPOSURE IN F. VALUES					
F.2.	F. 2.2	F. 2.3	F. 2.4	F. 2.5	F. 2.6
2.3	2.5	2.7	2.8	2.9	3.
2.8	3.1	3.3	3.4	3.5	3.6
3.2	3.5	3.7	3.8	4.	4.1
4.	4.4	4.6	4.9	5.	5.1
4.5	4.9	5.3	5.5	5.6	5.8
5.6	6.1	6.6	6.8	7.	7.3
6.3	6.7	7.4	7.7	7.9	8.1
8.	8.7	9.3	9.8	10.1	10.4
9.1	9.9	10.6	11.1	11.4	11.7
11.3	12.2	13.2	13.6	14.1	14.5
12.5	13.6	14.5	15.2	15.6	16.
16.	17.4	18.6	19.4	19.8	20.3
18.	19.5	20.1	21.8	22.3	22.7
22.	23.8	25.6	26.7	27.4	28.2
25.	27.1	29.	30.3	31.3	32.5
32.	35.	37.	39.	40.	41.

NOTE: This chart is read the same as preceeding page. Normal exposure with 170 shutter is in first column on left. When larger shutter opening is to be used, read F. value in that column opposite normal F. value. EXAMPLE: F.8 with 170 shutter is equivalent to F.9.3 with 230 shutter.

CAMERA SPEED CONSTANT

SHUTTER EXPOSURE

IN FRACTIONS OF A SECOND

Exposure Time Obtained with
Various Camera Speeds and
Shutter Openings

CAMERA SPEEDS

SHUTTER OPENING	2 Pictures per Second	4 Pictures per Second	6 Pictures per Second	8 Pictures per Second
170°	1/4	1/8	1/12	1/17
160°	1/4	1/9	1/13	1/18
150°	1/4	1/9	1/13	1/19
140°	1/5	1/10	1/15	1/20
130°	1/5	1/11	1/16	1/22
120°	1/6	1/12	1/18	1/24
110°	1/6	1/13	1/19	1/26
100°	1/7	1/14	1/21	1/29
90°	1/8	1/16	1/24	1/32
80°	1/9	1/18	1/27	1/36
70°	1/10	1/20	1/30	1/41
60°	1/12	1/24	1/36	1/48
50°	1/14	1/28	1/42	1/57
40°	1/18	1/36	1/54	1/72
30°	1/24	1/48	1/72	1/96
20°	1/36	1/72	1/108	1/144
10°	1/72	1/144	1/216	1/288
5°	1/144	1/288	1/432	1/576

LENS DIAPHRAGM OPENING CONSTANT

SHUTTER EXPOSURE

IN FRACTIONS OF A SECOND

Exposure Time Obtained with
Various Camera Speeds and
Shutter Openings

CAMERA SPEEDS

Shutter Opening	10 Pictures Per Second	12 Pictures Per Second	14 Pictures Per Second	16 Pictures Per Second
170°	1/21	1/25	1/30	1/34
160°	1/22	1/27	1/32	1/36
150°	1/23	1/28	1/33	1/38
140°	1/25	1/30	1/35	1/41
130°	1/27	1/33	1/38	1/44
120°	1/30	1/36	1/42	1/48
110°	1/34	1/39	1/45	1/52
100°	1/37	1/43	1/51	1/58
90°	1/40	1/48	1/56	1/64
80°	1/45	1/54	1/63	1/72
70°	1/52	1/62	1/72	1/82
60°	1/63	1/77	1/84	1/96
50°	1/74	1/91	1/103	1/115
40°	1/90	1/108	1/126	1/144
30°	1/120	1/144	1/168	1/192
20°	1/180	1/216	1/252	1/188
10°	1/360	1/432	1/504	1/576
5°	1/720	1/864	1/1008	1/1152

LENS DIAPHRAGM OPENING CONSTANT

SHUTTER EXPOSURE

IN FRACTIONS OF A SECOND

Exposure Time Obtained with Various Camera Speeds and Shutter Openings

CAMERA SPEEDS

Shutter Open'g	18 Pictures Per Second	20 Pictures Per Second	22 Pictures Per Second	24 Pictures Per Second
170°	1/38	1/42	1/46	1/51
160°	1/40	1/44	1/49	1/54
150°	1/42	1/46	1/51	1/57
140°	1/45	1/50	1/55	1/60
130°	1/49	1/54	1/60	1/66
120°	1/54	1/60	1/66	1/72
110°	1/60	1/68	1/73	1/78
100°	1/65	1/74	1/80	1/87
90°	1/72	1/80	1/88	1/96
80°	1/81	1/90	1/98	1/108
70°	1/92	1/102	1/113	1/123
60°	1/111	1/126	1/135	1/144
50°	1/131	1/148	1/165	1/182
40°	1/162	1/180	1/198	1/216
30°	1/216	1/240	1/264	1/288
20°	1/324	1/360	1/396	1/432
10°	1/648	1/720	1/792	1/864
5°	1/1296	1/1440	1/1589	1/1738

LENS DIAPHRAGM OPENING CONSTANT

SHUTTER EXPOSURE

IN FRACTIONS OF A SECOND

FOR AKELEY AND SPECIAL CAMERAS

Exposure Time Obtained with Various Camera Speeds and Shutter Openings

CAMERA SPEEDS

Shutter Opening	16 Pictures Per Second	18 Pictures Per Second	20 Pictures Per Second	24 Pictures Per Second
280°	1/20	1/23	1/25	1/30
270°	1/21	1/24	1/26	1/32
260°	1/22	1/25	1/27	1/33
250°	1/23	1/26	1/28	1/34
240°	1/24	1/27	1/30	1/36
230°	1/25	1/28	1/32	1/37
220°	1/26	1/29	1/34	1/39
210°	1/27	1/30	1/35	1/41
200°	1/28	1/31	1/36	1/44
195°	1/29	1/32	1/37	1/45
190°	1/30	1/33	1/38	1/46
185°	1/31	1/34	1/39	1/47
180°	1/32	1/35	1/40	1/48
175°	1/33	1/36	1/41	1/50
170°	1/34	1/38	1/42	1/51

LENS DIAPHRAGM OPENING CONSTANT

SHUTTER EXPOSURE

In Fractions of a Second

ULTRA-SPEED

Camera Speed

Shutter Opening	2 Times Normal	3 Times Normal	4 Times Normal	6 Times Normal	8 Times Normal
	EXPOSURE IN PARTS OF A SECOND				
170°	1/68	1/102	1/136	1/204	1/272
160°	1/72	1/108	1/144	1/216	1/288
150°	1/76	1/114	1/152	1/228	1/304
140°	1/82	1/123	1/164	1/246	1/328
130°	1/88	1/132	1/176	1/264	1/352
120°	1/96	1/146	1/196	1/292	1/396
110°	1/104	1/156	1/208	1/312	1/416
100°	1/116	1/174	1/232	1/348	1/464
90°	1/128	1/192	1/256	1/384	1/512
80°	1/144	1/216	1/288	1/432	1/576
70°	1/164	1/244	1/324	1/488	1/648
60°	1/192	1/288	1/384	1/576	1/768
50°	1/230	1/345	1/460	1/690	1/920
40°	1/288	1/432	1/576	1/864	1/1152
30°	1/384	1/576	1/768	1/1152	1/1536
20°	1/576	1/864	1/1152	1/1728	1/2304
10°	1/1152	1/1728	1/2304	1/3456	1/4608

This chart is based on hand crank operation with standard gear box of 16 pictures per second.

SHUTTER EXPOSURE

In Fractions of a Second

ULTRA-SPEED

Camera Speed

Shutter Opening	2 Times Normal	3 Times Normal	4 Times Normal	6 Times Normal	8 Times Normal
	EXPOSURE IN PARTS OF A SECOND				
170°	1/102	1/153	1/204	1/306	1/408
160°	1/108	1/162	1/216	1/324	1/432
150°	1/114	1/171	1/228	1/342	1/456
140°	1/120	1/180	1/240	1/360	1/480
130°	1/132	1/198	1/264	1/396	1/528
120°	1/144	1/216	1/288	1/432	1/576
110°	1/156	1/234	1/312	1/468	1/624
100°	1/174	1/261	1/348	1/522	1/696
90°	1/192	1/288	1/384	1/576	1/768
80°	1/216	1/324	1/432	1/648	1/864
70°	1/246	1/369	1/492	1/738	1/984
60°	1/288	1/432	1/576	1/864	1/1152
50°	1/364	1/546	1/728	1/1092	1/1456
40°	1/432	1/648	1/864	1/1296	1/1728
30°	1/576	1/864	1/1152	1/1728	1/2304
20°	1/864	1/1296	1/1728	1/2592	1/3456
10°	1/1728	1/2592	1/3456	1/5184	1/6912

This chart is based on standard motor operation of 24 pictures per second.

SPEED RATING SYSTEMS

Approximate Conversion and Comparison of Various Speed Rating Tables

A. S. A.*	Weston	General Electric	American Scheiner	European Scheiner	Hurter & Driffield	Din
1.0	0.7	1	8	14	17.5	1/10
1.2	1.0	1.5	9	15	25	2/10
1.6	1.2	2	10	16	30	3/10
2.0	1.5	2.5	11	17	38	4/10
2.5	2.0	3	12	18	50	5/10
3	2.5	4	13	19	63	6/10
4	3	4.5	14	20	75	7/10
5	4	6	15	21	100	8/10
6	5	8	16	22	125	9/10
8	6	10	17	23	150	10/10
10	8	12	18	24	200	11/10
12	10	16	19	25	250	12/10
16	12	20	20	26	300	13/10
20	16	24	21	27	400	14/10
25	20	32	22	28	500	15/10
32	24	40	23	29	600	16/10
40	32	48	24	30	800	17/10
50	40	64	25	31	1000	18/10
64	50	80	26	32	1250	19/10
80	64	100	27	33	1600	20/10
100	80	125	28	34	2000	21/10
125	100	150	29	35	2500	22/10
160	125	200	30	36	3120	23/10
200	160	250	31	37	4000	24/10
250	200	300	32	38	5000	25/10
320	250	400	33	39	6250	26/10
400	320	500	34	40	8000	27/10
500	400	600	35	41	1,0000	28/10
650	500	800	36	42	1,2500	29/10
800	650	900	37	43	1,6250	30/10
1000	800	1000	38	44	2,0000	31/10

*American Standards Association Film Numbers

ULTRA-SPEED CHART

LENS STOP CONVERSION FOR HI-SPEED OPERATION

F. Value Normal Speed	1½ Times Normal	2 Times Normal	3 Times Normal	4 Times Normal	5 Times Normal	6 Times Normal	7 Times Normal	8 Times Normal
	LENS STOPS COMPENSATED FOR SPEEDS ABOVE							
F.2.3	F.2.							
2.8	2.3	2.						
3.2	2.8	2.3	2.					
4.	3.2	2.8	2.3	2.				
4.5	4.	3.2	2.8	2.3	2.1	2.		
5.6	4.5	4.	3.2	2.8	2.5	2.3	2.1	2.
6.3	5.6	4.5	4.	3.2	3.	2.8	2.5	2.3
8.	6.3	5.6	4.5	4.	3.6	3.2	3.	2.8
9.1	8.	6.3	5.6	4.5	4.3	4.	3.6	3.2
11.3	9.1	8.	6.3	5.6	5.	4.5	4.3	4.
12.5	11.3	9.1	8.	6.3	5.9	5.6	5.	4.5
16.	12.5	11.3	9.1	8.	7.1	6.3	5.9	5.6
18.	16.	12.5	11.3	9.1	8.5	8.	7.1	6.3
22.	18.	16.	12.5	11.3	10.	9.1	8.5	8.
25.	22.	18.	16.	12.5	11.9	11.3	10.	9.1
32.	25.	22.	18.	16.	14.	12.5	11.9	11.3
36.	32.	25.	22.	18.	17.	16.	14.	12.5

NOTE: This chart is based on motor operation of 24 pictures per second. When hand cranking with standard gear box of 16 pictures per second, cut shutter to 120 degrees or close diaphragm another quarter of stop to compensate for difference in exposure.

FRAME TOTALIZER

FRAMES DIVIDED INTO SECONDS

Showing Amount of Frames Obtained at Various Speeds

	FRAMES PER SECOND					
	8	12	16	24	32	48
Seconds	Frames Obtained					
1	8	12	16	24	32	48
2	16	24	32	48	64	96
3	24	36	48	72	96	144
4	32	48	64	96	128	192
5	40	60	80	120	160	240
6	48	72	96	144	192	288
7	56	84	112	168	224	336
8	64	96	128	192	256	384
9	72	108	144	216	288	432
10	80	120	160	240	320	480
11	88	132	176	264	352	528
12	96	144	192	288	384	576
13	104	156	208	312	416	624
14	112	168	224	336	448	672
15	120	180	240	360	480	720
16	128	192	256	384	512	768
17	136	204	272	408	544	816
18	144	216	288	432	576	864
19	152	228	304	456	608	912
20	160	240	320	480	640	960
21	168	252	336	504	672	1008
22	176	264	352	528	704	1056
23	184	276	368	552	736	1104
24	192	288	384	576	768	1152
25	200	300	400	600	800	1200
26	208	312	416	624	832	1248
27	216	324	432	648	864	1296
28	224	336	448	672	896	1344
29	232	348	464	696	928	1392
30	240	360	480	720	960	1440

This chart applies to 35mm, 16mm and 8mm film.

FRAME TOTALIZER

Showing Amount of Frames in Various Footage Totals of 35 mm. Film

1/8 Foot = 2 Frames	5/8 Foot = 10 Frames
1/4 Foot = 4 Frames	3/4 Foot = 12 Frames
3/8 Foot = 6 Frames	7/8 Foot = 14 Frames
1/2 Foot = 8 Frames	1 Foot = 16 Frames

Feet	Pictures	Feet	Pictures	Feet	Pictures	Feet	Pictures	Feet	Pictures
1 =	16	23 =	368	45 =	720	67 =	1072	89 =	1424
2 =	32	24 =	384	46 =	736	68 =	1088	90 =	1440
3 =	48	25 =	400	47 =	752	69 =	1104	91 =	1456
4 =	64	26 =	416	48 =	768	70 =	1120	92 =	1472
5 =	80	27 =	432	49 =	784	71 =	1136	93 =	1488
6 =	96	28 =	448	50 =	800	72 =	1152	94 =	1504
7 =	112	29 =	464	51 =	816	73 =	1168	95 =	1520
8 =	128	30 =	480	52 =	832	74 =	1184	96 =	1536
9 =	144	31 =	496	53 =	848	75 =	1200	97 =	1552
10 =	160	32 =	512	54 =	864	76 =	1216	98 =	1568
11 =	176	33 =	528	55 =	880	77 =	1232	99 =	1584
12 =	192	34 =	544	56 =	896	78 =	1248	100 =	1600
13 =	208	35 =	560	57 =	912	79 =	1264	200 =	3200
14 =	224	36 =	576	58 =	928	80 =	1280	300 =	4800
15 =	240	37 =	592	59 =	944	81 =	1296	400 =	6400
16 =	256	38 =	608	60 =	960	82 =	1312	500 =	8000
17 =	272	39 =	624	61 =	976	83 =	1328	600 =	9600
18 =	288	40 =	640	62 =	992	84 =	1344	700 =	11200
19 =	304	41 =	656	63 =	1008	85 =	1360	800 =	12800
20 =	320	42 =	672	64 =	1024	86 =	1376	900 =	14400
21 =	336	43 =	688	65 =	1040	87 =	1392	1000 =	16000
22 =	352	44 =	704	66 =	1056	88 =	1408	2000 =	32000

HYPERFOCAL CHART

35 mm. CAMERAS

LENS SIZE

LENS OPENING	25 mm.		28 mm.		32 mm.		35 mm.		40 mm.		50 mm.	
	HYPERFOCAL DISTANCE											
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
F. 1.4	28	10	36	4	47	0	56	3	73	6	116	0
1.8	22	4	28	0	36	5	43	9	56	10	89	6
2.0	20	2	25	5	33	0	39	6	51	6	83	6
2.3	17	8	22	2	28	8	34	6	45	6	71	0
2.8	14	5	18	1	23	7	28	2	36	10	59	6
3.2	12	7	15	10	20	6	24	9	32	1	50	6
4.0	10	2	12	8	16	5	19	10	25	9	41	7
4.5	9	0	11	4	14	7	17	7	22	11	36	0
5.6	7	2	9	0	11	9	14	2	18	4	29	9
6.3	6	5	8	0	10	5	12	7	16	4	25	10
8.	5	0	6	4	8	2	9	11	12	10	20	10
9.1	4	5	5	7	7	3	8	9	11	4	17	11
11.	3	8	4	7	6	0	7	2	9	4	15	2
12.5	3	3	4	0	5	3	6	4	8	3	13	0
16.	2	6	3	10	4	1	5	0	6	5	10	2
18.	2	3	2	10	3	8	4	5	5	9	9	0
22.	1	10	2	4	3	0	3	7	4	8	7	5
25.	1	7	2	0	2	8	3	2	4	2	6	6
32.	1	3	1	7	2	0	2	5	3	3	5	0

Distance at and beyond which all objects are in focus when sharp focus is secured at infinity, however when a lens is focused on the hyperfocal distance, then everything from one half the hyperfocal distance to infinity will be sharply defined.

HYPERFOCAL CHART

35 mm. CAMERAS

LENS SIZE

LENS OPENING	60 mm.	75 mm.	100 mm.	110 mm.	125 mm.	150 mm.
	HYPERFOCAL DISTANCE					
	FEET	FEET	FEET	FEET	FEET	FEET
F. 1.4	164	259	460	560	722	1040
1.8	127	200	356	435	557	805
2.0	115	187	327	391	505	730
2.3	100	158	286	342	442	636
2.8	83	134	235	281	362	522
3.2	72	113	204	245	315	455
4.0	58	93	163	196	253	365
4.5	51	80	145	174	224	324
5.6	41	67	117	140	181	261
6.3	37	57	104	124	161	232
8.0	29	47	82	98	126	182
9.1	25	40	72	86	111	160
11.	21	34	60	71	92	132
12.5	18	29	52	63	81	116
16.	14	23	40	49	63	91
18.	13	20	36	43	56	81
22.	10	16	30	36	46	66
25.	9	14	26	31	40	58
32.	7	11	20	24	31	45

These tables are calculated for a circle of confusion of 1/500 of an inch.

CAMERA MOTOR SPEED
TIMING CHART

Footage Obtained at Various Timing and Speeds

Below Normal

Pictures per Second	Footage Obtained in 5 sec.	Footage Obtained in 10 sec.	Footage Obtained in 15 sec.	Footage Obtained in 20 sec.	Footage Obtained in 30 sec.
	Feet	Feet	Feet	Feet	Feet
24	7½	15	22½	30	45
22	6⅞	13¾	20⅝	27½	41¼
20	6¼	12½	18¾	25	37½
18	5⅝	11¼	16⅞	22½	33¾
16	5	10	15	20	30
14	4⅜	8¾	13⅛	17½	26¼
12	3¾	7½	11¼	15	22½
10	3⅛	6¼	9⅜	12½	18¾
8	2½	5	7½	10	15
6	1⅞	3¾	5⅝	7½	11¼
4	1¼	2½	3¾	5	7½
2	⅝	1¼	1⅞	2½	3¾
1	5/16	⅝	⅞	1¼	1⅞

⅛-ft. = 2 Frames	⅝-ft. = 10 Frames
¼-ft. = 4 Frames	¾-ft. = 12 Frames
⅜-ft. = 6 Frames	⅞-ft. = 14 Frames
½-ft. = 8 Frames	1-ft. = 16 Frames

CAMERA MOTOR SPEED
TIMING CHART

Footage Obtained at Various Timing and Speeds

Above Normal

Pictures per Second	Camera Speeds	Footage Obtained in 5 sec.	Footage Obtained in 10 sec.	Footage Obtained in 15 sec.	Footage Obtained in 30 sec.
		Feet	Feet	Feet	Feet
24	NORMAL	7½	15	22½	45
28	1¾ x 16	8¾	17½	26¼	52½
32	2 x 16	10	20	30	60
36	1½ x 24	11¼	22½	33¾	67½
48	3 x 16 2 x 24	15	30	45	90
64	4 x 16	20	40	60	120
72	3 x 24	22½	45	67½	135
80	5 x 16	25	50	75	150
96	6 x 16 4 x 24	30	60	90	180
112	7 x 16	35	70	105	210
120	5 x 24	37½	75	112½	225
128	8 x 16	40	80	120	240
144	9 x 16 6 x 24	45	90	135	270
160	10 x 16	50	100	150	300
168	7 x 34	52½	105	157½	315
176	11 x 16	55	110	165	330
192	12 x 16 8 x 24	60	120	180	360

CAMERA SET-UPS

Camera Distance for Normal Size Figures with Various Lenses

35 mm. CAMERAS

Lens Size in M.M.	Large Head		Head & Shoulders		Bust Figure		Waist Figure		Hip Size		Thigh Figure	
	Size of Image											
	12 in.		16 in.		20 in.		26 in.		30 in.		36 in.	
	DISTANCE FROM LENS TO SUBJECT											
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
25	1	6	2	2	2	8	3	4	4		4	8
32	1	10	2	9	3	2	4	2	5	1	6	
35	2		3		3	6	4	8	5	8	6	8
40	2	6	3	4	4	2	5	6	6	6	7	8
50	3	4	4	4	5	4	7		8	4	10	
75	4	10	6	10	8	2	10	8	12	6	14	8
100	6	9	8	10	11		13	2	16	2	19	4
125	8	6	11	2	13	9	17	8	20	8	24	8
150	10		13	4	16	8	21	2	24		28	6

Based on Sound Camera Aperture Size .631x.868

CAMERA SET-UPS

Camera Distance for Normal Size Figures with Various Lenses

35 mm. CAMERAS

Lens Size in M.M.	Knee Figure		Ankle Length		Short Figure		Medium Figure		Normal Figure		Tall Figure	
	Size of Image											
	48″		54″		5′		5′ 4″		5′ 8″		6″	
	DISTANCE FROM LENS TO SUBJECT											
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
25	6	4	7	4	8	4	8	8	9		9	8
32	8	4	9	2	10	2	10	6	11	2	12	6
35	9		10		11		11	8	12	6	13	4
40	10	3	11	8	12	8	13	6	14	6	15	2
50	13	2	14	8	16	6	17	6	18	6	19	6
75	19	8	22		24	4	26		27	8	29	2
100	25	6	28	8	32	2	34	3	36	3	38	6
125	32	9	36	8	40	9	43	3	46		48	8
150	38		42	2	47	2	50	2	53	6	56	

Based on Sound Camera Aperture Size .631x.868

FOOTAGE TIMER

Footage Obtained at Various Timing and Camera Speeds

Min. Sec.	4 Pictures Per Second	6 Pictures Per Second	8 Pictures Per Second	10 Pictures Per Second	12 Pictures Per Second
	Ft.	Ft.	Ft.	Ft.	Ft.
1	1/4	3/8	1/2	5/8	3/4
2	1/2	3/4	1	1 1/4	1 1/2
4	1	1 1/2	2	2 1/2	3
6	1 1/2	2 1/4	3	3 3/4	4 1/2
8	2	3	4	5	6
10	2 1/2	3 3/4	5	6 1/4	7 1/2
12	3	4 1/2	6	7 1/2	9
14	3 1/2	5 1/4	7	8 3/4	10 1/2
16	4	6	8	10	12
18	4 1/2	6 3/4	9	11 1/4	13 1/2
20	5	7 1/2	10	12 1/2	15
25	6 1/4	9 3/8	12 1/2	15 5/8	18 3/4
30	7 1/2	11 1/4	15	18 3/4	22 1/2
35	8 3/4	13 1/8	17 1/2	21 7/8	26 1/4
40	10	15	20	25	30
45	11 1/4	16 7/8	22 1/2	28 1/8	33 3/4
50	12 1/2	18 3/4	25	31 1/4	37 1/2
55	13 3/4	20 5/8	27 1/2	34 3/4	41 1/4
1 Min.	15	22 1/2	30	37 1/2	45
2 Min.	30	45	60	75	90
3 Min.	45	67 1/2	90	112 1/2	135
4 Min.	60	90	120	150	180
5 Min.	75	112 1/2	150	187 1/2	225

FOOTAGE TIMER

Footage Obtained at Various Timing and Camera Speeds

Min. Sec.	14 Pictures Per Second	16 Pictures Per Second	18 Pictures Per Second	20 Pictures Per Second	22 Pictures Per Second
	Ft.	Ft.	Ft.	Ft.	Ft.
1	⅞	1	1⅛	1¼	1⅜
2	1¾	2	2¼	2½	2¾
4	3½	4	4½	5	5½
6	5¼	6	6¾	7½	8¼
8	7	8	9	10	11
10	8¾	10	11¼	12½	13¾
12	10½	12	13½	15	16½
14	12¼	14	15¾	17½	19¼
16	14	16	18	20	22
18	15¾	18	20¼	22½	24¾
20	17½	20	22½	25	27½
25	21⅞	25	28⅛	31¼	34⅜
30	26¼	30	33¾	37½	41¼
35	30⅝	35	39⅜	43¾	48⅛
40	35	40	45	50	55
45	39⅜	45	50⅝	56¼	61⅞
50	43¾	50	56¼	62½	68¾
55	48⅛	55	61⅞	68¾	75⅝
1 Min.	52½	60	67½	70	82½
2 Min.	105	120	135	140	165
3 Min.	157½	180	202	210	247½
4 Min.	210	240	270	280	330
5 Min.	262½	300	337½	350	412½

FOOTAGE TIMER

Footage Obtained at Various Timing and Camera Speeds

Min. Sec.	24 Pictures Per Second	26 Pictures Per Second	28 Pictures Per Second	30 Pictures Per Second	32 Pictures Per Second
	Ft.	Ft.	Ft.	Ft.	Ft.
1	1½	1⅝	1¾	1⅞	2
2	3	3¼	3½	3¾	4
4	6	6½	7	7½	8
6	9	9¾	10½	11¼	12
8	12	13	14	15	16
10	15	16¼	17½	18¾	20
12	18	19½	21	22½	24
14	21	22¾	24½	26¼	28
16	24	26	28	30	32
18	27	29¼	31½	33¾	36
20	30	32½	35	37½	40
25	37½	40⅝	43¾	46⅞	50
30	45	48¾	52½	56¼	60
35	52½	56⅞	61¼	65⅝	70
40	60	65	70	75	80
45	67½	73⅛	78¾	84⅜	90
50	75	81¼	87½	93¾	100
55	82½	89⅜	96¼	103⅛	110
1 Min.	90	97½	105	112½	120
2 Min.	180	195	210	225	240
3 Min.	270	292½	315	337½	360
4 Min.	360	390	420	450	480
5 Min.	450	497½	525	562½	600

FOOTAGE TIMER
Ultra Speed
Footage Obtained at Various Timing and Camera Speeds

Min. Sec.	2 Times Normal	3 Times Normal	4 Times Normal	6 Times Normal	8 Times Normal
	Ft.	Ft.	Ft.	Ft.	Ft.
1	2	3	4	6	8
2	4	6	8	12	16
3	6	9	12	18	24
4	8	12	16	24	32
5	10	15	20	30	40
6	12	18	24	36	48
8	16	24	32	48	64
10	20	30	40	60	80
12	24	36	48	72	96
14	28	42	56	84	112
16	32	48	64	96	128
18	36	54	72	108	144
20	40	60	80	120	160
25	50	75	100	150	200
30	60	90	120	180	240
35	70	105	140	210	280
40	80	120	160	240	320
45	90	135	180	270	360
50	100	150	200	300	400
55	110	165	220	330	440
1 Min.	120	180	240	360	480
2 Min.	240	360	480	720	960
3 Min.	360	540	720	1080	1440

This chart is based on hand crank operation with standard gear box of 16 pictures per second.

FOOTAGE TIMER
Ultra Speed

Footage Obtained at Various Timing and Camera Speeds

Min. Sec.	2 Times Normal	3 Times Normal	4 Times Normal	6 Times Normal	8 Times Normal
	Ft.	Ft.	Ft.	Ft.	Ft.
1	3	4½	6	9	12
2	6	9	12	18	24
3	9	13½	18	27	36
4	12	18	24	36	48
5	15	22½	30	45	60
6	18	27	36	54	72
8	24	36	48	72	96
10	30	45	60	90	120
12	36	54	72	108	144
14	42	63	84	126	168
16	48	72	96	144	192
18	54	81	108	162	216
20	60	90	120	180	240
25	75	112½	150	225	300
30	90	135	180	270	360
35	105	157½	210	315	420
40	120	180	240	360	480
45	135	202½	270	405	540
50	150	225	300	450	600
55	165	247½	330	495	660
1 Min.	180	270	360	540	720
2 Min.	360	540	720	1080	1440
3 Min.	540	810	1080	1620	2880

This chart is based on standard motor operation of 24 pictures per second.

FOOTAGE TIMER

35 mm. Cameras and Projectors

SILENT SPEED—16 PICTURES PER SECOND

Seconds		1 Min.	2 Min.	3 Min.	4 Min.	5 Min.	6 Min.	7 Min.	8 Min.	9 Min.	10 Min.
FOOTAGE OBTAINED AT THE TIMING ABOVE											
0		60	120	180	240	300	360	420	480	540	600
2	2	62	122	182	242	302	362	422	482	542	602
4	4	64	124	184	244	304	364	424	484	544	604
6	6	66	126	186	246	306	366	426	486	546	606
8	8	68	128	188	248	308	368	428	488	548	608
10	10	70	130	190	250	310	370	430	490	550	610
12	12	72	132	192	252	312	372	432	492	552	612
14	14	74	134	194	254	314	374	434	494	554	614
16	16	76	136	196	256	316	376	436	496	556	616
18	18	78	138	198	258	318	378	438	498	558	618
20	20	80	140	200	260	320	380	440	500	560	620
22	22	82	142	202	262	322	382	442	502	562	622
24	24	84	144	204	264	324	384	444	504	564	624
26	26	86	146	206	266	326	386	446	506	566	626
28	28	88	148	208	268	328	388	448	508	568	628
½ Min	30	90	150	210	270	330	390	450	510	570	630
32	32	92	152	212	272	332	392	452	512	572	632
34	34	94	154	214	274	334	394	454	514	574	634
36	36	96	156	216	276	336	396	456	516	576	636
38	38	98	158	218	278	338	398	458	518	578	638
40	40	100	160	220	280	340	400	460	520	580	640
42	42	102	162	222	282	342	402	462	522	582	642
44	44	104	164	224	284	344	404	464	524	584	644
46	46	106	166	226	286	346	406	466	526	586	646
48	48	108	168	228	288	348	408	468	528	588	648
50	50	110	170	230	290	350	410	470	530	590	650
52	52	112	172	232	292	352	412	472	532	592	652
54	54	114	174	234	294	354	414	474	534	594	654
56	56	116	176	236	296	356	416	476	536	596	656
58	58	118	178	238	298	358	418	478	538	598	658

These figures represent the footage of the combined time of the top minute column, plus the seconds column on left, for example:

250 feet takes 4 minutes and 10 seconds to run.

400 feet takes 6 minutes and 40 seconds to run.

FOOTAGE TIMER

35 mm. PROJECTORS

Silent Speed 60 Feet per Minute

Minutes		½ HOUR	1 HOUR	1½ HOURS	2 HOURS	2½ HOURS
FOOTAGE OBTAINED AT THE TIMING ABOVE						
0		1800	3600	5400	7200	9000
1	60	1860	3660	5460	7260	9060
2	120	1920	3720	5520	7320	9120
3	180	1980	3780	5580	7380	9180
4	240	2040	3840	5640	7440	9240
5	300	2100	3900	5700	7500	9300
6	360	2160	3960	5760	7560	9360
7	420	2220	4020	5820	7620	9420
8	480	2280	4080	5880	7680	9480
9	540	2340	4140	5940	7740	9540
10	600	2400	4200	6000	7800	9600
11	660	2460	4260	6060	7860	9660
12	720	2520	4320	6120	7920	9720
13	780	2580	4380	6180	7980	9780
14	840	2640	4440	6240	8040	9840
15	900	2700	4500	6300	8100	9900
16	960	2760	4560	6360	8160	9960
17	1020	2820	4620	6420	8220	10020
18	1080	2880	4680	6480	8280	10080
19	1140	2940	4740	6540	8340	10140
20	1200	3000	4800	6600	8400	10200
21	1260	3060	4860	6660	8460	10260
22	1320	3120	4920	6720	8520	10320
23	1380	3180	4980	6780	8580	10380
24	1440	3240	5040	6840	8640	10440
25	1500	3300	5100	6900	8700	10500
26	1560	3360	5160	6960	8760	10560
27	1620	3420	5220	7020	8820	10620
28	1680	3480	5280	7080	8880	10680
29	1740	3540	5340	7140	8940	10740

These figures represent the footage of the combined time of the top hour column, plus the minute column on left: For example: 4200 feet takes 1 hour and 10 minutes to run; 7440 feet takes 2 hours and 4 minutes to run.

FOOTAGE TIMER

35 mm. Cameras and Projectors

SOUND SPEED—24 PICTURES PER SECOND

Seconds		1 Min.	2 Min.	3 Min.	4 Min.	5 Min.	6 Min.	7 Min.	8 Min.	9 Min.	10 Min.
FOOTAGE OBTAINED AT THE TIMING ABOVE											
0		90	180	270	360	450	540	630	720	810	900
2	3	93	183	273	363	453	543	633	723	813	903
4	6	96	186	276	366	456	546	636	726	816	906
6	9	99	189	279	369	459	549	639	729	819	909
8	12	102	192	282	372	462	552	642	732	822	912
10	15	105	195	285	375	465	555	645	735	825	915
12	18	108	198	288	378	468	558	648	738	828	918
14	21	111	201	291	381	471	561	651	741	831	921
16	24	114	204	294	384	474	564	654	744	834	924
18	27	117	207	297	387	477	567	657	747	837	927
20	30	120	210	300	390	480	570	660	750	840	930
22	33	123	213	303	393	483	573	663	753	843	933
24	36	126	216	306	396	486	576	666	756	846	936
26	39	129	219	309	399	489	579	669	759	849	939
28	42	132	222	312	402	492	582	672	762	852	942
½ Min	45	135	225	315	405	495	585	675	765	855	945
32	48	138	228	318	408	498	588	678	768	858	948
34	51	141	231	321	411	501	591	681	771	861	951
36	54	144	234	324	414	504	594	684	774	864	954
38	57	147	237	327	417	507	597	687	777	867	957
40	60	150	240	330	420	510	600	690	780	870	960
42	63	153	243	333	423	513	603	693	783	873	963
44	66	156	246	336	426	516	606	696	786	876	966
46	69	159	249	339	429	519	609	699	789	879	969
48	72	162	252	342	432	522	612	702	792	882	972
50	75	165	255	345	435	525	615	705	795	885	975
52	78	168	258	348	438	528	618	708	798	888	978
54	81	171	261	351	441	531	621	711	801	891	981
56	84	174	264	354	444	534	624	714	804	894	984
58	87	177	267	357	447	537	627	717	807	897	987

These figures represent the footage of the combined time of the top minute column, plus the seconds column on left, for example:

300 feet takes 3 minutes and 20 seconds to run.

786 feet takes 8 minutes and 44 seconds to run.

FOOTAGE TIMER

35 mm. Projectors

SOUND SPEED—90 FEET PER MINUTE

Minutes		½ Hour	1 Hour	1½ Hour	2 Hour	2½ Hour
	FOOTAGE OBTAINED AT THE TIMING ABOVE					
0		2700	5400	8100	10800	13500
1	90	2790	5490	8190	10890	13590
2	180	2880	5580	8280	10980	13680
3	270	2970	5670	8370	11070	13770
4	360	3060	5760	8460	11160	13860
5	450	3150	5850	8550	11250	13950
6	540	3240	5940	8640	11340	14040
7	630	3330	6030	8730	11430	14130
8	720	3420	6120	8820	11520	14220
9	810	3510	6210	8910	11610	14310
10	900	3600	6300	9000	11700	14400
11	990	3690	6390	9090	11790	14490
12	1080	3780	6480	9180	11880	14580
13	1170	3870	6570	9270	11970	14670
14	1260	3960	6660	9360	12060	14760
15	1350	4050	6750	9450	12150	14850
16	1440	4140	6840	9540	12240	14940
17	1530	4230	6930	9630	12330	15030
18	1620	4320	7020	9720	12420	15120
19	1710	4410	7110	9810	12510	15210
20	1800	4500	7200	9900	12600	15300
21	1890	4590	7290	9990	12690	15390
22	1980	4680	7380	10080	12780	15480
23	2070	4770	7470	10170	12870	15570
24	2160	4860	7560	10260	12960	15660
25	2250	4950	7650	10350	13050	15750
26	2340	5040	7740	10440	13140	15840
27	2430	5130	7830	10530	13230	15930
28	2520	5220	7920	10620	13320	16020
29	2610	5310	8010	10710	13410	16110

These figures represent the footage of the combined time of the top hour column, plus the minute column on left, for example:

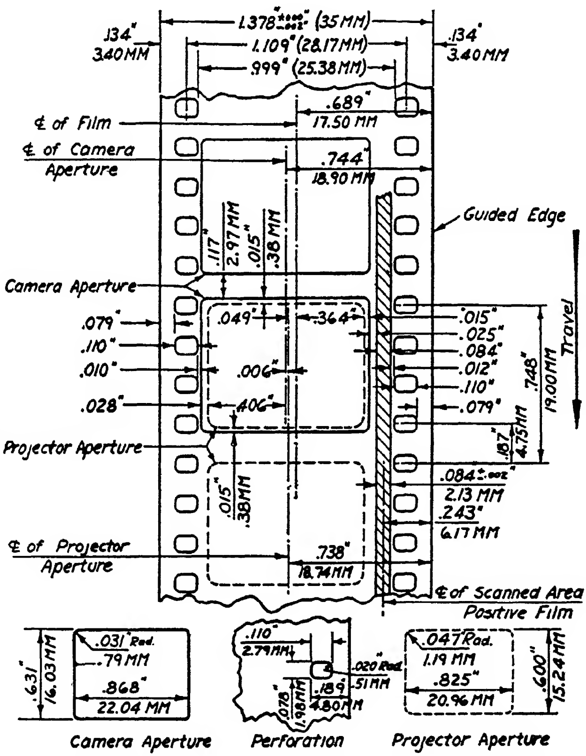
6750 feet takes 1 hour and 15 minutes to run.

3600 feet takes ½ hour and 10 minutes (40 min.) to run.

STANDARD 35-MM. SOUND FILM

CAMERA APERTURE, PROJECTOR APERTURE, AND SCANNED AREA

These dimensions and locations are shown relative to unshrunk raw stock. Positive; emulsion side up. Negative; emulsion side down.



In the camera the emulsion side of the film faces the objective. Viewed from the objective the sound track is to the left.

In the projector the emulsion side of the film faces the light source. Viewed from the light source the sound track is to the right.

NEGATIVE DEVELOPING CHART

Time Equalizer for Various Temperatures

TEMPERATURES						
50°	55°	60°	65°	70°	75°	80°
TIME EQUIVALENTS IN MINUTES						
ABOVE NORMAL			NORMAL	BELOW NORMAL		
4	3¼	2½	2	1½	1¼	1⅛
4¾	3¾	3	2½	2	1½	1¼
5½	4½	3½	3	2¼	1¾	1½
6	5	4¼	3½	2¾	2	1¾
7	5½	4¾	4	3	2¼	2
8	6½	5½	4½	3½	2¾	2¼
9	7¼	6	5	4	3¼	2¾
10	8¼	6¾	5½	4½	3¾	3¼
11¼	9¼	7½	6	4¾	4	3⅜
11¾	9¾	8	6½	5¼	4¼	3½
12¼	10	8½	7	5¾	4¾	4
13¾	11½	9½	8	6¾	5¾	4¾
16	13¾	11¾	10	8¼	7	6
19	16	14	12	10	8¾	7½
24	21	18	15	12	10½	8½
30	27	23	20	17	15	13
36	32	28	25	22	20	17
46	40	35	30	25	22	19
58	51	45	40	32	28	24
74	64	56	50	40	32	28
84	74	66	60	48	40	35

NOTE—This chart is intended only to serve as a general guide for the development of average negatives. Unusual conditions, change of formula or individual treatment will naturally change time given.

NEGATIVE DEVELOPERS

FINE GRAIN FORMULAS

Eastman Borax No. D76

	Avoirdupois	Metric
Water	32 Ozs.	1 Liter
Elon	30 Grs.	2 Grams
Sodium Sulphite—Dry	3½ Ozs.	100 Grams
Hydroquinone	75 Grs.	5 Grams
Borax	30 Grs.	2 Grams

Developing Time 9 to 12 Minutes at 65° F.

Dupont Borax Formula

Water	32 Ozs.	1 Liter
Rhodol or Metol	38 Grs.	2.5 Grams
Sodium Sulphite—Dry	2¾ Ozs.	75 Grams
Hydroquinone	46 Grs.	3 Grams
Borax	77 Grs.	5 Grams

Developing Time 5 to 7 Minutes at 65° F.

ANSCO FORMULA NO. 17

Hot Water (125F or 52C)	24 Ozs.	750 CC
Ansco Metol	22 Grs.	1.5 Grams
Ansco Sulphite (Anhydrous)	2¾ Ozs.	80 Grams
Ansco Hydroquinone	45 Grs.	3 Grams
Borax	45 Grs.	3 Grams
Ansco Potassium Bromide	7½ Grs.	5 Grams
Water to make	32 Ozs.	1 Liter

Developing Time 8 to 15 Minutes at 65° F.

Extreme Fine Grain Formula

Water	32 Ozs.	1 Liter
Paraphenylene Diamine	146 Grs.	10 Grams
Sodium Sulphite—Anhydrous	3 Ozs.	90 Grams
Glycin	15 Grs.	1. Gram

Developing Time 20 to 25 Minutes at 68° F.

Dissolve all chemicals in the order given using luke warm water—add cold water to complete formula.

POSITIVE DEVELOPERS

EASTMAN POSITIVE DEVELOPER No. D. 16

	Avoirdupois	Metric
Water	1 Gal.	3.785 Liters
Elon	17 Grs.	1.102 Grams
Sodium Sulphite-Dessicated	5¼ Ozs.	148.85 Grams
Hydroquinone	350 Grs.	22.680 Grams
Sodium Carbonate-Dessicated	2½ Ozs.	70.88 Grams
Potassium Bromide	50 Grs.	3.240 Grams
Citric Acid	40 Grs.	1.592 Grams
Potassium Meta-Bisulphite	85 Grs.	5.508 Grams

Developing Time 7 Minutes at 65°F.

DUPONT POSITIVE DEVELOPER

	Avoirdupois	Metric
Water	32 Ozs.	1.0 Liter
Metol	85 Grs.	5.508 Grams
Sodium Sulphite-Dessicated	370 Grs.	4.536 Grams
Hydroquinone	50 Grs.	3.240 Grams
Sodium Carbonate-Dessicated	360 Grs.	3.888 Grams
Potassium Bromide	8 Grs.	.518 Grams

Developing Time 4 Minutes at 65°F.

ANSCO NO. 21 POSITIVE DEVELOPER

	Avoirdupois	Metric
Hot Water (125 F. or 52C)	24 Ozs.	750 CC
Ansco Metol	14 Grs.	.9 Gram
Ansco Sodium Sulphite	380 Grs.	26 Grams
Ansco Hydroquinone	96 Grs.	6.6 Grams
Ansco Sodium Carbonate	470 Grs.	32 Grams
Ansco Potassium Bromide	13 Grs.	.9 Gram
Ansco Meta-bisulphite	70 Grs.	4.75 Grams
Water to make	32 Ozs.	1 Liter

Developing Time 5 Minutes at 65°F.

CONTRAST TITLE DEVELOPER

	Avoirdupois	Metric
Water About 125° F.	16 Ozs.	½ Liter
Elon	14 Grs.	.907 Grams
Sodium Sulphite	2½ Ozs.	70.88 Grams
Hydroquinone	130 Grs.	8.424 Grams
Sodium Carbonate	360 Grs.	23.328 Grams
Potassium Bromide	70 Grs.	4.536 Grams
Cold Water To Make	32 Ozs.	1.0 Liter

Developing Time 5 Minutes at 65°F.

DISSOLVE CHEMICALS IN ORDER GIVEN

FIXING SOLUTIONS

and Other Formulas

NEGATIVE FIXING SOLUTION

	AVOIRDUPOIS	METRIC
SOLUTION No. 1		
Hypo	2 Lbs.	960.0 Grams
Sodium Sulphite—Dessicated	2 Ozs.	60.0 Grams
Water to Make	96 Ozs.	3.0 Liters
SOLUTION No. 2		
Water	32 Ozs.	1.0 Liters
Potassium Chrome Alum	2 Ozs.	60.0 Grams
Sulphuric Acid C.P.	¼ Oz.	8.0 C. C.

Dissolve chemicals in order given. Pour Solution No. 2 into Solution No. 1 stirring Solution No. 1 rapidly.

POSITIVE FIXING SOLUTION

SOLUTION No. 1	AVOIRDUPOIS	METRIC
Water	64 Ozs.	2.0 Liters
Hypo	16 Ozs.	480.0 Grams
SOLUTION No. 2		
Water About 125° F.	5 Ozs.	160.0 C.C.
Sodium Sulphite—Dessicated	1 Oz.	30.0 Grams
Acetic Acid 28% Pure	3 Ozs.	96.0 C. C.
Potassium Alum	1 Oz.	30.0 Grams

Dissolve chemicals in order given. Pour Solution No. 2 into Solution No. 1 stirring Solution No. 1 rapidly.

STAIN REMOVER FOR NEGATIVES

SOLUTION No. 1	AVOIRDUPOIS	METRIC
Water	32 Ozs.	1.0 Liter
Potassium Permanganate	75 Grs.	5.3 Grams
SOLUTION No. 2		
Water	32 Ozs.	1.0 Liter
Sodium Chloride	2½ Ozs.	75.0 Grams
Sulphuric Acid	½ Oz.	16.0 C. C.

USE EQUAL PARTS OF No. 1 and No. 2. Mix fresh. Harden negative for a few minutes in a 5% solution of Formalin—wash well and immerse in Solution No. 1 until bleached, rinse well and re-develop in any non-staining developer. Any stain of bleach bath may be removed in a weak solution of Sodium Bisulphite.

STAIN REMOVER FOR HANDS

	AVOIRDUPOIS	METRIC
SOLUTION No. 1		
Water	32 Ozs.	1.0 Liters
Potassium Permanganate	¼ Oz.	7.5 Grams
SOLUTION No. 2		
Water	32 Ozs.	1.0 Liter
Sodium Bisulphite	16 Ozs.	450.0 Grams

FOR USE—Darken hands with Solution No. 1. Rinse well. Then bleach in Solution No. 2. Wash thoroughly.

REDUCERS

REDUCER FOR CONTRASTY NEGATIVES

Eastman Modified Belitzski Formula R-8

	Avoirdupois	Metric
Ferric Chloride (Crystals)	3 Ozs. 145 Grs.	25.0 Grams
Potassium Citrate	10 Ozs.	75.0 Grams
Sodium Sulphite (Dessicated)	4 Ozs.	30.0 Grams
Citric Acid	2 Ozs. 290 Grs.	20.0 Grams
Hypo	1 Lb. 11 Ozs.	200.0 Grams
Water to Make	1 Gal.	1.0 Liter

Dissolve chemicals in order given. Wash well after reduction.

Two Solution
Farmers Reducer Formula R4-b

SOLUTION A		
Potassium Ferricyanide	1 Oz.	7.5 Grams
Water to Make	1 Gal.	1.0 Liter
SOLUTION B		
Hypo	1 Lb. 11 Ozs.	200.0 Grams
Water to Make	1 Gal.	1.0 Liter

Immerse either negative or positive film in Solution A, with uniform agitation, for from one to four minutes at 65° to 70° depending upon degree of reduction desired. Then immerse in Solution B for five minutes and wash thoroughly.

INTENSIFIERS

Mercury Intensifier Formula IN-1

Mercuric Chloride	3 Ozs.	22.5 Grams
Potassium Bromide	3 Ozs.	22.5 Grams
Water to Make	1 Gal.	1.0 Liter

Bleach films completely, then wash for five minutes and re-develop in any non-staining developer, or blacken in 10% Ammonia solution.

Chromium Intensifier Formula IN-4a

Potassium Bichromate	25 Grs.	8.0 Grams
Hydrochloric Acid C.P.	¾ Oz.	6.0 CC.
Water to Make	1 Gal.	1.0 Liter

Bleach completely, wash thoroughly, re-develop in fast Elon-Hydro developer. Rinse well. Fix for five minutes and then wash thoroughly.

TONING FORMULAS

FOR POSITIVE FILM

BLUE TONER

	AVOIRDUPOIS	METRIC
SOLUTION No. 1		
Water	8 Gals.	40 Liters
Potassium Ferricyanide	12 Ozs.	375 Grams
Potassium Bichromate	7 Grs.	½ Gram
SOLUTION No. 2		
Water	8 Gals.	40 Liters
Iron Ammonia Alum	13½ Ozs.	425 Grams
Oxalic Acid	1 Lb.	500 Grams

Pour Solution No. 1 into Solution No. 2 stirring rapidly. Wash films thoroughly before using toner. Clear slight stain in weak fixing bath. Wash well.

YELLOW BROWN TONER

	AVOIRDUPOIS	METRIC
SOLUTION No. 1		
Water	2 Gals.	10 Liters
Potassium Ferricyanide	1 Lb.	500 Grams
Potassium Bichromate—1% Sol.	1½ Ozs.	50 C. C.
SOLUTION No. 2		
Water	8 Gals.	40 Liters
Uranium Nitrate	1 Lb. 1½ Ozs.	550 Grams
Oxalic Acid	1 Lb.	500 Grams

Pour Solution No. 1 into Solution No. 2 stirring rapidly. Any stain caused from long use of solution may be removed by adding more Oxalic Acid.

REDDISH BROWN TONE

	AVOIRDUPOIS	METRIC
SOLUTION No. 1		
Water	4 Gals.	20 Liters
Potassium Ferricyanide	12¾ Ozs.	400 Grams
Potassium Bichromate—1% Sol.	1½ Ozs.	50 C. C.
SOLUTION No. 2		
Water	6 Gals.	30 Liters
Copper Sulphate	1 Lb.	500 Grams
Sodium Citrate	5 Lbs.	2500 Grams

Pour Solution No. 1 into Solution No. 2 stirring rapidly. Wash films well before and after toning. Protect solutions from strong sunlight. Best results are obtained if prints are slightly lighter before toning.

GREEN GRASS TONE

	AVOIRDUPOIS	METRIC
SOLUTION No. 1		
Water	10 Gals.	50 Liters
Potassium Ferricyanide	2 Lbs.	1000 Grams
SOLUTION No. 2		
Water	10 Gals.	50 Liters
Iron Perchloride	2 Lb.	1000 Grams
Potassium Bromide	1 Lb.	500 Grams
Oxalic Acid	1 Lb.	500 Grams

Wash films well. BLEACH in solution No. 1—wash well until yellowish stain is gone. TONE in solution No. 2.

WEIGHTS AND MEASURES

and Conversion Tables

AVOIRDUPOIS WEIGHT

Pound	Ounces	Drachms	Grains	Grams
1	16	256	7000	453.60
	1	16	437.5	28.35
		1	27.34	1.77

TROY WEIGHT

Pound	Ounces	Penny-weights	Grains	Grams
1	12	240	5760	373.24
	1	20	480	31 10
		1	24	1.56

FLUID MEASURE

Gallon	Quarts	Pints	Ounces	Drachms	Minims
1	4	8	128	1024	61440
	1	2	32	256	15360
		1	16	128	7680
			1	8	480
				1	60

APOTHECARIES WEIGHT

Pound	Ounces	Drachms	Scruples	Grains	Grams
1	12	96	288	5760	373.24
	1	8	24	480	31.10
		1	3	60	3.89
			1	20	1.30
				1	.06

The pound, ounce and grain are the same as in troy weight.

METRIC	U. S.
1 Gram	= 15.43 Grains
1 Gram	=.0352 Ounce
1 Liter	= .2641 Gallon
1 Liter	= 1.056 Quart
1 Liter	= 33.81 Ounces
1 Meter	= 39.37 Inches
1 Millimeter	= .0393 Inches
1 Cubic Centimeter	= .3937 Inch
1 Kilogram	— 2.204 Pounds

U. S.		METRIC
1 Grain	=	0.648 Grams
1 Ounce	=	28.35 Grams
1 Pound	=	453.59 Grams
1 Liquid Ounce	=	29.57 C. C.
1 Pint	=	473.18 C. C.
1 Quart	=	.946 Liters
1 Gallon	=	3.785 Liters
1 Inch	=	25.4 M. M.
1 Foot	=	304.8 M. M
1 Yard	=	914.4 M. M.

1 GALLON = 3785.43 Cubic Centimeters

WEIGHTS and MEASURES
and CONVERSION TABLES

Fluid Ounces	to	Cubic Centimeters
oz		cc
1	=	30
2	=	59
3	=	89
4	=	118
5	=	148
6	=	177
7	=	207
8	=	237
9	=	266
10	=	296
11	=	325
12	=	355
13	=	384
14	=	414
15	=	444
16	=	473
24	=	710
32	=	946
64	=	1892
128	=	3785

Cubic Centimeters	to	Minims
1	=	16.2
2	=	32.6
3	=	48.6
4	=	64.9
5	=	81.1
6	=	97 3
7	=	113.6
8	=	129.8
9	=	146.0
10	=	162.3
15	=	243.4
20	=	324.6
25	=	405.7
30	=	486.8
35	=	567.9
40	=	649.2
50	=	811.4
60	=	973.7
70	=	1135.9
80	=	1298.2
90	=	1460.5
100	=	1622.8

FEET TO METERS

Feet		Meters
3	=	.91
4	=	1.22
5	=	1.52
6	=	1.83
7	=	2.13
8	=	2.44
9	=	2.74
10	=	3.05
12	=	3.66
15	=	4.57
20	=	6.10
25	=	7.62
30	=	9.14
40	=	12.19
50	=	15.24
75	=	22.86
100	=	30.48
150	=	45.72
200	=	60.96
300	=	91.44
400	=	121.92
500	=	152.40
1000	=	304.80

METERS TO FEET

Meters		Ft.	In.
1	=	3	3
1¼	=	4	1
1½	=	4	11
2	=	6	7
2½	=	8	2
3	=	9	10
4	=	13	1
5	=	16	5
6	=	19	8
7	=	23	
8	=	26	3
9	=	29	6
10	=	32	10
15	=	49	3
20	=	65	7
30	=	98	5
50	=	164	

Cubic Centimeters	to	Fluid Ounces
30	=	1.
50	=	1.69
75	=	2.54
100	=	3.38
150	=	5.07
175	=	5.92
200	=	6.76
300	=	10.14
400	=	13.52
500	=	16.91
600	=	20.29
700	=	23.67
800	=	27.05
900	=	30.43
1000	=	33.80
1100	=	37.18
1200	=	40.56
1300	=	43.94
1400	=	47.32
1500	=	50.70

Square Inches		Square Centimeters
1	=	6.45
2	=	12.90
3	=	19.35
4	=	25.87
5	=	32.25
6	=	38.71
7	=	45.16
8	=	51.61
9	=	58.06
10	=	64.52
15	=	96.77
20	=	129.53
25	=	162.39
30	=	195.15
35	=	227.91
40	=	260.66
45	=	293.42
50	=	326.18

WEIGHTS AND MEASURES

and Conversion Tables

INCHES TO MILLIMETERS		MILLIMETERS TO INCHES		GRAINS TO GRAMS		GRAMS TO GRAINS	
				Avoir.	Metric	Metric	Avoir.
In.	mm.	M.M.	IN.	Grains	Grams	Grams	Grains
1/16	1.6	1	.04	1	.065	1	15.4
1/8	3.2	2	.08	2	.130	2	30.9
3/16	4.8	3	.12	3	.194	3	46.3
1/4	6.4	4	.16	4	.259	4	61.7
5/16	7.9	5	.20	5	.324	5	77.1
3/8	9 5	6	.24	6	.389	6	92 6
7/16	11.1	7	.28	7	.453	7	108.1
1/2	12.7	8	.32	8	.518	8	123.5
9/16	14.3	9	.36	9	.583	9	138.9
5/8	15.9	10	.39	10	.648	10	154.3
11/16	17.5	12	.47	20	1.296	20	308.6
3/4	19.1	14	.55	30	1.944	30	463.0
13/16	20.7	16	.63	40	2.592	40	617.3
7/8	22.2	18	.71	50	3.240	50	771.5
15/16	.23.8	20	.79	60	3.888	60	925.6
1 in.	25.4	22	.87	70	4.536	70	1080.0
2 in.	50.8	24	.94	80	5.184	80	1235.0
3 in.	76.2	25	.98	90	5 832	90	1390.0
4 in.	101.6	25.4	1.00	100	6 480	100	1543.0

OUNCES TO GRAMS		GRAMS TO OUNCES		OUNCES TO GRAINS		GRAINS TO OUNCES	
				Ozs.	Grains	Grains	Ozs.
Oz.	Grams	Grams	Ozs.	1/4	109	30	.07
1/4	7.0	5	.18	1/2	219	50	.11
1/2	14.1	10	.35	3/4	328	60	.14
3/4	21 2	15	.53	1	437	80	.18
1	28.3	20	.71	1 1/4	547	90	.21
2	56.7	25	.88	1 1/2	656	100	.23
3	85 0	35	1.23	1 3/4	765	150	.34
4	113.4	50	1.76	2	875	200	.46
5	141.7	100	3.53	2 1/4	984	250	.57
6	170.1	150	5 29	2 1/2	1094	300	.69
7	198.4	200	7.05	2 3/4	1203	400	.92
8	226.8	250	8.81	3	1312	500	1.15
9	255 1	300	10.58	4	1750	750	1.72
10	283.5	350	12.34	5	2185	1000	2.29
11	311.8	400	14.10	6	2625	2000	4.58
12	340.2	450	15.87	7	3060	3000	6.88
13	368.5	500	17.63	8	3500	4000	9.16
14	398 8	600	21.16	9	3940	5000	11.45
15	425.2	800	28.21	10	4375	6000	13.75
16	453.6	1000	35 27	16	7000	7000	16.00

WEIGHTS AND MEASURES

and Conversion Tables

INCHES TO CENTIMETERS

Inches		Centimeters
1	=	2.54
2	=	5.08
3	=	7.62
4	=	10.16
5	=	12.70
6	=	15.24
7	=	17.78
8	=	20.32
9	=	22.86
10	=	25.40
11	=	27.94
12	=	30.48
13	=	33.02
14	=	35.56
15	=	38.10
16	=	40.64
17	=	43 18
18	=	45 72
19	=	48 26
20	=	50.80
21	=	53.34
22	=	55 88
23	=	58.42
24	=	60.96
25	=	63.50

CENTIMETERS TO INCHES

Centimeters		Inches
1	=	00.4
2	=	00.8
3	=	01.2
4	=	01.6
5	=	02.0
6	=	02.4
7	=	02.8
8	=	03.1
9	=	03.5
10	=	03.9
11	=	04.3
12	=	04 7
13	=	05.1
14	=	05.5
15	=	05 9
16	=	06 3
17	=	06.7
18	=	07.1
19	=	07.5
20	=	07.9
21	=	08.3
22	=	08.7
23	=	09.0
24	=	09.4
25	=	09.8
25.4	=	1.0

U.S. GALLONS TO LITERS

U.S. Gallons		Liters
1	=	3.78
2	=	7.47
3	=	11.35
4	=	15.14
5	=	18.92
6	=	22.71
7	=	26.49
8	=	30.28
9	=	34.06
10	=	37.85
20	=	75.70
30	=	113.56
40	=	151.41
50	=	189 26

LITERS TO U.S. GALLONS

Liters		U.S. Gallons
1	=	.264
2	=	.528
3	=	.792
4	=	1.056
5	=	1.320
6	=	1.585
7	=	1.849
8	=	2.113
9	=	2 377
10	=	2.641
20	=	5.283
30	=	7.925
40	=	10.567
50	=	13.208

CUBIC INCHES TO CENTIMETERS

Cubic Inches		Cubic Centimeters
1	=	16.38
2	=	32.77
3	=	49.16
4	=	65.54
5	=	81.93
6	=	98.32
7	=	114.71
8	=	131.10
9	=	147.48
10	=	163.87

CUBIC INCHES TO CUBIC CENTIMETERS

Cubic Inches		Cubic Centimeters
20	=	327.74
30	=	491.61
40	=	655.48
50	=	819.36
60	=	983.23
70	=	1147.1
80	=	1311.0
90	=	1474.8
100	=	1638.7
200	=	3277.4

COMPARISON OF THERMOMETER SCALES

Equivalence of Centigrade and Fahrenheit Thermometers

Centigrade		Fahrenheit	Centigrade		Fahrenheit
5	=	41.0	28	=	82.4
6	=	42.8	29	=	84.2
7	=	44.6	30	=	86.0
8	=	46.4	31	=	87 8
9	=	48.2	32	=	89.6
10	=	50.0	33	=	91.4
11	=	51.8	34	=	93.2
12	=	53.6	35	=	95.0
13	=	55.4	36	=	96.8
14	=	57.2	37	=	98.6
15	=	59 0	38	=	100.4
16	=	60.8	39	=	102.2
17	=	62.6	40	=	104.0
18	=	64.4	41	=	105.8
19	=	66.2	42	=	107.6
20	=	68.0	43	=	109.4
21	=	69.8	44	=	111.2
22	=	71.6	45	=	113.0
23	=	73.4	46	=	114.8
24	=	75.2	47	=	116.6
25	=	77.0	48	=	118.4
26	=	78.8	49	=	120.2
27	=	80.6			

EMERGENCY COIN WEIGHTS

COINS		GRAINS		GRAMS
Dollar	=	412.5	=	26.73
½ Dollar	=	192.9	=	12.50
Quarter	=	96.4	=	6.25
Nickel	=	77.1	=	5.0
Cent	=	48.	=	3.11
Dime	=	38.5	=	2.50

LIGHTING EQUIPMENT

All photographic lighting equipment can be divided into two broad groups, according to whether the unit is used for spotlighting or floodlighting purposes. The former is characterized by a concentrated beam of high intensity and controllable spread. The latter by a smooth radiation of relatively lesser power, covering as a rule a fixed angle of about 60°. These units may be further grouped according to whether they use carbon arcs or incandescent filament ("Mazda") globes as their light source.

The floodlighting units are used to provide a uniform overall minimum-exposure level of illumination, to lighten shadows, to illuminate backings, and to give a soft general front-lighting in close shots of people.

The spotlighting units, the beams of which may be accurately controlled as to both intensity and spread, are used for more specific lighting purposes—for creating effects of roundness and depth (modelling) in both sets and players by means of highlights and halftones, and to project light into deep sets.

The newer Fresnel-lensed spotlights, typified by the Mole-Richardson "Solarspots" (incandescent) and "Molarcs" (carbon arc) are characterized by a wider range of beam-spreads (generally from 8° to 45°) and a more uniform distribution of light within the beam at all spreads. They have rendered obsolete the older parabolic-mirror spotlights, which had a limited range and uneven beam distribution, and the condensing-lens spotlights which had a smooth beam but lacked intensity. This is especially the case when using the new fast films.

Tungsten filament light sources may be used in illuminating for both black and white, and color photography. For those color processes balanced for daylight illumination, the incandescent light sources may be used provided their radiation is corrected to daylight quality. Use CP (3350*K) type globes at their rated socket voltages, and correct the quality with "Whiterlite," or other suitable filters. For those color photographic processes balanced for other than daylight quality, strict attention should be given to the lighting method recommended by the film manufacturer.

Modern arcs have been developed specifically for the requirements of natural-color photography, and are universally used on Technicolor productions. The Duarc gives a light closely matched to natural daylight; the high-intensity arc spotlights require only a very light straw-colored gelatin filter to match this standard. The arc spotlights are also used in monochrome cinematography to simulate sunlight and to create strong lighting effects where "hard" shadows are required.

INCANDESCENT BULBS FOR STUDIO LIGHTING

"MP" Type Lamps for Black and White Photography

Bulb No.	Rated Watts	Type*	Volts	Amps.	Base
1	10,000	G-96	110-115-120	87.0	Mogul Bipost
2	5,000	G-64	110-115-120	43.5	Mogul Bipost
3	2,000	G-48	110-115-120	17.4	Mogul: Bipost or Screw
4	1,500	PS-52	110-115-120	13.1	Mogul Screw
5	1,000	PS-52	110-115-120	8.7	Mogul Screw
7	1,000	G-48	110-115-120	8.7	Mogul Bipost
8	1,000	G-40	110-115-120	8.7	Medium Bipost
9	750	T-24	110-115-120	6.5	Med. Bipost
10	500	T-20	110-115-120	4.4	Medium Screw Bipost or Pre-focus

"CP" (3350 K) Type lamps, plus filter.
For color processes requiring daylight quality illumination.

Bulb No.	Rated Watts	Type*	Volts	Amps.	Base
13	10,000	G-96	115	87.0	Mogul Bipost
14	5,000	G-64	115	43.5	Mogul Bipost
15	2,000	G-48	115	17.4	Mogul Bipost
16	2,000	PS-52	105-120	17.4	Mogul Screw
17	500	T-20	115	4.4	Med. Bipost
18	750	T-24	115	6.5	Med. Bipost

OTHER TYPES FREQUENTLY USED IN STUDIO WORK

Bulb No.	Rated Watts	Type*	Volts	Amps.	Base
19	1,000	PS-35 (No. 4	105-120 Photoflood)	8.7	Mogul Screw
20	500	A-25 (No. 2	105-120 Photoflood)	4.4	Medium Screw
21	250	A-21 (No. 1	105-120 Photoflood)	2.2	Medium Screw
22	200	T-10	120	1.7	D.C. Bayonet

*BULB TYPES: G—Spherical; PS—Pear Shaped; T—Tubular; A—Modified Pear Shaped. Numbers refer to diameter in ⅛ inches.

INCANDESCENT LAMPS

NAME	TYPE	Nominal Wattage	Degrees Beam Divergence		Bulb* No. (B&W)	Bulb* No. (Color)
			Spot	Flood		
MR Type #214 & 414 Senior Solarspot	14″ Fresnel-lens, high-power spotlamp	5000	10	44	2	14
MR Type #210 & 410 Junior Solarspot	9⅞″ Fresnel-lens, medium-power spotlamp	2000	10	44	3, 7	15
MR Type #206 & 406 Baby Solarspot	6″ Fresnel-lens, "baby Junior" spotlamp	750	10	40	9, 10	17, 18
MR Type 404 Midget Solarspot	$4\frac{15}{32}$″ Fresnel-lens, "Midget" spotlamp	200	8	50	22	
#36″ Sun Spot	36″ Parabolic-mirror high-power spotlamp	10,000	12	24	1	13
#MR Type 226 24″ Sun Spot	24″ Parabolic-mirror high-power spotlamp	5000	12	24	2	14
#MR Type 220 18″ Sun Spot	18″ Parabolic-mirror medium-power spotlamp	2000	8	18	3, 7	15
#MR Type 26 Studio Spotlamp	8″ plano-convex condensing lens with auxiliary spherical mirror, medium-power spotlamp	2000	8	44	3, 7	15

INCANDESCENT LAMPS (Continued)

NAME	TYPE	Nominal Wattage	Degrees Beam Divergence		Bulb* No. (B&W)	Bulb* No. (Color)
			Spot	Flood		
#MR Type 36 Studio Spotlamp	6″ plano-convex lens, condenser-spotlamp	1000	8	44	8	
Double Broadside	Twin-globe floodlight	2000		90	5 (Two)	19 (Two)
Single Broadside	Single-globe floodlight	1000		90	19	19
#MR Type 45 Rifle Lamp	Single-globe floodlight, rifled, metal reflector	1500		60	4, 5	16
MR Type 16 Cinelite	Portable floodlight, quick-demountable	1000		60	19	19
#Overhead Strip	Trough unit of 5 globes for floodlighting	5000			5 (Five)	19 (Five)
Sky Pan	Shallow diffuse reflector for lighting backings	5000		180	2	14

Wattages quoted are approximate, as practically all types are used on occasion with smaller globes than normal. This is especially the case when using the new fast films.

*BULB NUMBERS refer to description in table on page 167.

#Indicates obsolete or obsolescent type.

CARBON ARC LAMPS

NAME	TYPE	Degrees Beam Divergence		Positive Carbon No.	Negative Carbon No.
		Spot	Flood		
"M-R Type 27 or 29"	Twin arc floodlight	. .	90	1	10
MR Type 40 Duarc Broadside	Continuous feed twin arc floodlight	. .	90	1	16
MR Type 65 "MOLARC"	65 Amp. high intensity rotary-carbon spotlamp, Fresnel lens, 8 in. diameter.	8	44		11
MR Type 90 "MOLARC"	120 Amp. High intensity rotary-carbon spotlamp, Fresnel lens. 14 in. diameter.	8		5	14
MR Type 170 "MOLARC"	150 Amp. High intensity rotary carbon spotlamp, Fresnel lens, 20 in. diameter.	8	48	6	15
MR Type 450 "MOLARC"	215-Amp. Super-High-Intensity rotary-carbon spot lamp, Fresnel lens—24 in. diameter	8	44	7	17
*24 inch Sun Arc	High intensity rotary mirror spotlamp, parabolic	10	24	6	13
*36 inch Sun Arc	High intensity rotary mirror spotlamp, parabolic	0	32	6	13
*80-Amp. Rotary Spot	High intensity rotary-carbon spotlamp, plano-convex condenser lens. Not suitable for color photography	8	30	4	12
80-Amp. (Converted)	High intensity rotary-carbon spotlamp, converted to modern trim and Fresnel lens	8		3	12

CARBON NUMBERS refer to in table on Page 171

*Indicates obsolescent type.

CARBONS
FOR STUDIO LIGHTING

Carbon No.	DESCRIPTION	Amperes	Arc Volts
	POSITIVE CARBONS		
1	8mm. x12" CC MP Studio	38–43	35–43
2	9mm. x 20" High Low Projector	62–67	53–55
3	11mm. x 20" HI Proj. pregraphited	90–95	62–65
4	½" x 12" 80-Amp. Rotary Spot	75–80	50–55
5	13.6mm. x 22" HI MP Studio pregraphited	115–125	58–63
6	16mm. x 20" HI MP Studio pregraphited	145-155	65–72
7	16mm. x 22" Super HI Studio	210–225	70–75
	NEGATIVE CARBONS		
10	8mm. x 12" CC MP Studio		
11	7mm. x 9" Oro Type C		
12	⅜" x 9" Cored 80-Amp. Rotary Spot		
13	11mm. x 10" HI Special Studio		
14	$\frac{7}{16}$" x 8½" MP Studio		
15	½" or $\frac{15}{32}$" x 8½" MP Studio		
16	7mm. x 9" CC MP Studio		
17	$\frac{17}{32}$" x 9" CC Heavy Duty Orotip		

INCANDESCENT EQUIPMENT
BARDWELL & McALISTER

NAME	TYPE	Nominal Wattage	Degrees Spot	Beam Flood	Bulb No.
B & M SENIOR	#19 Fresnel Lens	5 KW	4°	44°	2–14
B & M JUNIOR	#14 Fresnel Lens	2 KW	4°	44°	3–15
B & M BABY KEG	#6 Fresnel Lens	¾ KW	4°	44°	9–18
B & M DINKY INKIE	#4 Fresnel Lens	150 W	4°	44°	. . . .
B & M SINGLE BROAD	#12 Factorlite Diffusion Single Globe	¾ KW	. .	. . .	9–18
B & M DOUBLE BROAD	#20 Florentine Diffusion Double Globe	2 KW	. .	. . .	3-16-19
B & M SKY PAN	#5 Open	5 KW	. .	. . .	2–14
B & M CONVERSION	#T-5 Soft or Hard Mirror Fresnel Lens	5 KW	. .	. . .	2-3-14-15
B & M BOOM LIGHT	Fresnel Lens (Baby Keg)	¾ KW	4°	44°	9–18
B & M FOCO SPOT	Condencer lens #6-E Attachment for Baby Keg	. . . .	Spot 3¾″ to 8′6″ At 15 Feet		. . . .

THE MAURER 16MM SOUND RECORDING SYSTEM

The Maurer 16mm Sound Recording System is designed to produce professional quality sound-on-film with a minimum experience requirement on the part of the operator. Although designed primarily for studio work, the Maurer Recording System lends itself very easliy to location recording because of its easy portability. No compromise with quality is permitted in the sound track produced with the Maurer Recording System.

The complete Maurer Sound-on-Film Recording System is contained in four small portable carrying cases. The first case hold the 16mm recorder and two 400-foot gear-driven feed and take-up film magazines. In the recorders is the new Maurer Model "H" recording galvanometer and optical system, with its feature of direct negative and direct positive recording. The Maurer Model "H" recording optical system has an unprecedentedly high light output, thereby permitting the use of the finest grain, highest resolving film obtainable. All parts of the film drive in the new Maurer Recorder have been increased in size, thereby decreasing the amount of flutter in the recording to less than onehalf of its previously very low value. The recording galvanometer is tuned to a resonant frequency of 12,000 cycles. The Maurer recorder has a reversing switch, thereby permitting recording with film flowing in either direction. This is of extreme importance in obtaining proper emulsion position without the necessity of intermediate prints when recording for different picture production methods.

The second principal unit of the Maurer Recording System is the recording amplifier. The Maurer recording amplifier has four mixer inputs—one low level microphone input, and three high level film phonograph or disc inputs. A separate control is provided for each of the inputs with a master gain control for the overall volume. In addition to the standard ouputs to the recorded, and to the monitor head phones, two additional outputs are providede. One permits monitoring through a monitor loud speaker in addition to the head phone monitors, and the second output is used when it is desired to record on disc or wire simultaneously with the film recording, for immediate playback. An AGN circuit, or noise reduction amplifier, is built into the Maurer Recording Amplifier. This circuit applies a bias current to the coil of the recording galvanometer, thereby eliminating background noise. A compressor amplifier, to limit track width to 100 per cent modulation, is also included in the recording amplifier circuit. A three-position low frequency speech-and-music equalizer is provided, as well as a two-position high frequency equalizer for use in Kodachrome recording or in re-recording. A dummy load for use during rehearsals is built in the amplifier, with warning lights on the panel indicating the record and standby positions. This contributes to longer exposure lamp life. All the controls other than switches for the operation of the entire Maurer Recording System are contained on the panel of the Maurer Recording Amplifier.

The third unit of the Maurer Recording System is the power supply unit. This unit is designed to operate from 110-volts, 60-cycles, although it can be supplied to operate from different voltages and different frequencies. The Maurer power supply unit furnishes all AC and DC operating voltages for the recording amplifier and for the exposure lamp in the recorder.

The fourth case of the Maurer Recording System is designed to hold all accessories. These accessories are furnished as part of the standard recording system and include a high quality microphone, 100 feet of microphone cable, head phones, a constant voltage regulator and all cables.

The entire Maurer Recording System can be set up ready for operation within ten minutes. The actual operation of the Maurer Recording System is extremely simple because the entire monitoring process consists of riding one needle on the DB meter. All other circuits are pre-set and automatically operated. The rugged specifications to which the Maurer Recording System is built insure years of trouble-free operation.

Where it is necessary to make a long continuous record, film magazines of 1200-foot capacity are available. This provides means for making a continuous recording of over thirty-three minutes.

SUPERFLOOD EXPOSURE DATA

BLACK AND WHITE

IN TAKING indoor pictures with photofloods, at least two should be used at one time—one on each side of the subject, and both in reflectors shining directly at the subject. Tables below are computed for use with Wabash Superfloods only. Directions for using Flood Numbers are the same as for Flash Numbers.

Superflood Bulb Size	Shutter Speed (Seconds)	FILM SPEEDS (Weston Tungsten Rating) 16	20	32	40	64	125
One No. 1 in reflector	1	#80	#90	#115	#130	#160	#224
	1/5	#37	#40	#52	#58	#74	#104
	1/25	#16	#18	#24	#26	#32	#45
	1/50	#12	#13	#16	#18	#24	#34
	1/100	#8	#9	#12	#13	#16	#22
	Movie*	#14	#*6	#19	#22	#28	#39
Two No. 1 or One No. 2 in reflector or One R-2 Reflector Flood	1	#115	#130	#160	#180	#230	#322
	1/5	#50	#58	#74	#80	#100	#140
	1/25	#23	#26	#32	#36	#46	#64
	1/50	#16	#18	#24	#26	#32	#45
	1/100	#12	#13	#16	#18	#24	#34
	Movie*	#19	#22	#28	#30	#38	#53
Four No. 1 or Two No. 2 or One No. 4 in Reflectors or Two R-2 Reflector Flood	1	#160	#180	#230	#257	#320	#448
	1/5	#73	#80	#100	#115	#146	#204
	1/25	#33	#36	#46	#52	#66	#92
	1/50	#23	#26	#32	#36	#46	#64
	1/100	#16	#18	#24	#26	#32	#45
	Movie*	#28	#30	#40	#444	#56	#79

*Movie—Based on 16 frames per second.

NOTE—Exposure meters wherever possible should be employed for accurate "f" stop.

SUPERFLOOD EXPOSURE DATA

COLOR

IN TAKING pictures with artificial light indoors, correct lighting requires absolute exclusion of daylight, as the mixture of daylight and photoflood light results in a "duo" effect that cannot be controlled. The same is true of house lighting mixed with photoflood lighting. The placement of lights is important, as placement too close or too far from the subject results in underexposure or overexposure, while placement at incorrect lighting angles results in shadows effect that are too contrasty for good color rendition. In general, flat front lighting with the lamps placed as close to the camera as possible, is best. Shadows for contrast should be avoided as the colors in the film itself will provide all the contrast needed.

The following Flood Numbers are computed for indoor use with Ansco Tungsten or Kodachrome Types A and B color films and Wabash Superfloods, with the bulbs used in front lighting directed at the subject. For additional back lighting, side lighting or angle lighting used for supplementary effect, no additional exposure need be figured.

Superflood Bulb Size	Shutter Speed (Seconds)	COLOR FILMS KB or AT (1)	KA (2)
One No. 1 in reflector	1	#45	# 58
	1/5	#20	#26
	1/25	#9	#12
	1/50	...	#8
	Movie*	#8	#9.5
Two No. 1 or One No. 2 in reflectors or One R-2 Reflector Flood	1	#65	#80
	1/5	#29	#37
	1/25	#13	#16
	1/50	#9	#12
	1/100	...	#8
	Movie*	#11	#14
Four No. 1 or Two No. 2 or One No. 4 in reflectors or Two R-2 Reflector Flood	1	#90	#115
	1/5	#40	#50
	1/25	#18	#23
	1/50	#13	#16
	1/100	#9	#12
	Movie*	#15	#20

*Movie—Based on 16 frames per second. (1) KB—Kodachrome Type B. AT—Ansco Tungsten.

(2) KA—Kodachrome Type A.

WABASH EXPOSURE DATA

Black and White Flash Photography

Determining Correct Exposure by the Flash Number Method

THE FLASH Number method detailed below is recommended as one of the easiest to use and to remember. Each flashbulb size has a Flash Number for the film and shutter speed used. You merely divide the Flash Number by the distance in feet between flashbulb and subject to get your f stop.

Example: Using Press 40 with a film having a Weston Tungsten Rating of 32, and a shutter speed of 1/100th second, the Flash Number listed is #160. If the distance between flashbulb and subject is 10 feet, the lens opening would be f/16.

Flashbulb Size	Shutter Speed (Seconds)	FILM SPEEDS (Weston Tungsten Rating) 16	32	64	125
SF	Up to 1/100	#80	#110	#155	#210
	1/200	#60	#85	#120	#165
Press 5	Up to 1/50	#160	#230	#340	#400
(In midget	1/200	#110	#160	#230	#300
designed	1/200	#80	#110	#160	#230
reflector	1/400	#65	#90	#130	#180
No. 0	Up to 1/50	#130	#180	#250	#310
	1/100	#90	#130	#180	#220
	1/200	#65	#90	#130	#170
	1/400	#50	#75	#115	#140
Press 40	Up to 1/50	#160	#230	#340	#450
	1/100	#110	#160	#230	#300
	1/200	#80	#110	#160	#220
	1/400	#60	#90	#140	#200
Press 50	Up to 1/50	#190	260	#370	#480
	1/100	#130	#190	#270	#360
	1/200	#95	#130	#190	#270
	1/400	#80	#110	#160	#230
No. 2	Up to 1/50	#230	#320	#450	#550
	1/100	#180	#250	#340	#450
	1/200	#120	#160	#230	#320
No. 3	Time, Bulb	#300	#450	#600	#740
	1/25	#280	#425	#570	#740
	1/50	#270	#415	#555	#735
	1/100	#200	#280	#400	#555

When using an additional lamp of the same size in a similar reflector at an angle from 0° to 10° from camera to subject, one full f stop smaller should be employed.

COLOR WITH SUPERFLASH

SUPERFLASH STANDARD BULBS

SUPERFLASH technique is ideal for color photography because of the ease with which correct lighting can be obtained. Another advantage is that the certain, very definite light intensity stored in each Superflash bulb can be used with a considerable degree of accuracy and uniformity.

When making color pictures with synchronized flashbulbs, both the subject and the background should be well and evenly illuminated. Contrasty lighting and deep shadows should be avoided. The colors in the film itself will provide all the contrast needed and all the modeling required, if the exposure is correct.

For color flash photography indoors with Ansco Tungsten or Kodachrome Type A and B color films, the standard line Superflash bulbs should be used with the filters recommended to help equalize the respective Kelvin temperatures of flashbulb and color film. The following Flash Numbers are computed for use with Superflash only and between-the-lens shutters.

Flashbulb Size	Shutter Speed (Seconds)	COLOR FILMS AT (1)	KA (2)	KB (3)
SF	Up to 1/100	#45	#55	#35
	1/200	#35	#40	#25
Press 25	Up to 1/50	#75	#100	#70
	1/100	#65	#85	#60
	1/200	#45	#70	#40
	1/400	#30	#45	#20
No. 0	Up to 1/50	#65	#90	#60
	1/100	#55	#75	#50
	1/200	#40	#60	#30
	1/400	#30	#45	#20
Press 40	Up to 1/50	#95	#110	#75
	1/100	#75	#90	#60
	1/200	#50	#75	#40
	1/400	#40	#50	#30
Press 50	Up to 1/50	#110	#125	#85
	1/100	#85	#110	#70
	1/200	#50	#85	#45
	1/400	#50	#75	#40
No. 2	Up to 1/50	#135	#150	#95
	1/100	#95	#120	#80
	1/200	#75	#95	#55
No. 3	Time, Bulb	#190	#200	#140
	1/25	#175	#185	#120
	1/50	#160	#175	#110
	1/100	#120	#160	#100
No. 2A Focal Plane Only	Time, Bulb	#140	#160	#100
	1/200	#35	#40	#25
	1/400-1/550	#25	#30	#15
	" " 1/1000	#15	#20	#10

(1) AT—Ansco Tungsten. Use with a UV-16 filter.
(2) KA—Kodachrome Type A. Use with a chrome-flash filter of the Wratten or Omag type.
(3) KB—Kodachrome Type B. Use with a Wratten No. 2A filter or the CC series.

WHAT LENS COATING MEANS

By Dr. A. F. Turner

BAUSCH & LOMB OPTICAL CO., Rochester, New York

Lens coating is a process in which thin films of transparent materials are applied to the optical surfaces of a lens system.

By properly choosing the film material and controlling its thickness, reflection may be greatly diminished, and the over-all transmission of the system increased by an amount which depends on the number of surfaces coated.

Although the reflection loss at a single surface is only about 5%, the cumulative loss of light in passing through several surfaces becomes appreciable. For example, a camera or projector lens with eight surfaces misdirects or discards as much as 34% of the light incident upon it, whereas an instrument with 20 surfaces would discard 64%.

Much of this loss can be reclaimed by coating the surfaces. At present, in commercially available processes, the average reflection loss can be decreased from 5% to 1½% or 1% per surface, depending on certain requirements, in particular, durability. This results in a 30% increase in the transmission of the above lens with eight surfaces, or a 128% increase in the transmission of the instrument with 20 surfaces.

A second advantage accruing from the use of coated lenses is the reduction of flare arising from inter-reflections between the lens surfaces. In fact, the improvement in performance because of decreased flare is often more striking than that due to the gain in transmission.

The optical principle to which the film coatings owe their effectiveness in reducing reflections and thereby increasing transmission is known as interference. If two light waves are in step, they reinforce each other; if out of step, they cancel. In coated optics, the two waves with which we are dealing are those reflected from the front and rear surfaces of the applied films. The two waves can be put out of step or in step by adjusting the thickness of the film. This same phenomenon is responsible for the colors of thin films of oil on water, and for the varied hues of iridescent glass. The light reflected from filmed surfaces is colored because the film is not equally effective for all wave lengths.

A word about the manufacture of the films: The most usual commercial method now employed is deposition in high vacuum. The lenses and prisms to be coated are mounted on holders and placed in a vacuum system. The material to be evaporated is heated, and the vapor which forms condenses on the surfaces as a uniform film.

First introduced commercially more than five years ago, the Bausch & Lomb Super Cinephor coated projection lens showed an increase in transmission of more than one-third. This obvious improvement, measurable on the screen with a footcandle meter insured its success.

Moreover, in an untreated projection lens, the forward reflections arising from multiple scattering within the lens throw an out-of-focus veil of light over the screen. Similarly, the back reflections throw scattered light over the whole frame, and these may illuminate dark or low light regions of the film. Both types or reflections degrade the contrast of the projected image. Both are practically eliminated by coating, with a resulting greater image contrast.

The same general results as obtained with projection lenses are found upon coating a camera lens—improved speed and reduction of flare. In this case, reduction of flare is probably the more important advantage although there are often circumstances where the increased speed is a definite help.

ACME OPTICAL PRINTER

The need for a commercially built optical printer capable of handling all classes of production work as required by the major picture studios, has resulted in the construction of a machine which embodies many radically new features.

To insure the extreme accuracy demanded by the present day professionals, this machine has been built to the highest standards of optical and mechanical precision.

The Acme Optical Printer was designed to meet the demand for speed, dependability, accuracy, ease of operation and maintenance and is a very versatile machine with a wide variety of features.

In addition to the conventional type of straight optical printing with light corrections, it may also be used for normal contact printing, either step or continuous.

Among the varieties of its uses are, simultaneous double printing, dissolves, wipe-offs, traveling mattes, stop-framing, reverse action special effects, enlargements and zoom or dolly shots to any portion of the frame and any practical combination of frame printing are made automatically and even the most difficult and tedious of operations are simply and quickly done.

Threading is simple and fool-proof, the film is simply looped over the sprockets between the idlers and on to the take-up reels which operate on the non-break friction principles.

The projector movement which accommodates two films without adjustment and the pressure plate assembly is deisgned for simple and ease of operation with accuracy of registration provided by pilot pin assemblies.

Perhaps the most interesting feature of The Acme Optical Printer is its principle of control. Since all controls are on one side, within easy reach, the need for assistant or extra operators is eliminated. The printer requires only one worker for all its operations. Printing speeds from 2½ feet up to 40 feet per minute gives him the variety of selection for the most efficient type of work to be done.

Other improvements include a specially designed lamp-house that gives even illumination over the entire field with or without diffusion; a ground glass view finder fitted with registration pins for film line-up work, and a variable high speed rewind on the projector enables the operator to quickly select any desired frame or scene.

The camera and projector each has friction film take-ups, the camera having an anti-buckle switch operating both forward and reverse film travel. The projector movement accommodates two films without adjustment and the two take-up spindles in the magazine are separately clutched and handle rolls of different sizes.

The projector and lens move independently, both vertically and horizontally and the amount of travel is shown on dial indicators graduated to .001 of an inch.

Either the camera or projector are quickly interchanged for 16mm heads, for blow-up, reduction or straight 16 mm work.

Accessories include a wipe-off device to make wipes without the use of film mattes at any angle and degree of softness; an optical spinner to make whirling, rocking and tilted scenes; a matte holder for 4-way adjustable mattes; iris and optical glass for painted mattes. A built-in 80 speed drive runs these devices to make effects of any desired length.

MAX FACTOR'S MAKE-UP CHART
for Black-and-White Photography

The Colorings of Panchromatic Make-Up are neutral tones of tan and warm brown. When it is completely applied, the effect is a monotone complexion, which is the correct color for the best black-and-white photographic results with any type of film stock used.

	GIRLS		MEN	
	Blonde	*Brunette*	*Blonde*	*Brunette*
Pancro Foundation	27	26	28	28
" Face Powder	27	26	28	28
" Lining Color	22	22	22	22
" Masque	Brown	Brown	Brown	Brown
" Eyebrow Pencil	Brown	Brown	Brown	Brown
" Moist Rouge	Studio Special	Studio Special	8	8

	ELDERLY TYPES		CHILDREN	
	Women	*Men*	*Female*	*Male*
Pancro Foundation	26	27	24	25
" Face Powder	26	27	24	25
" Lining Color	22	22	22	22
" Moist Rouge	Studio Special	8	8	8
" Masque	Brown	Brown	Brown	Brown
" Eyebrow Pencil	Brown	Brown	Brown	Brown

Panchromatic Satin Smooth Foundation and Pancake Make-Up Items Are Known by Numbers, as Follows:

Pancro Powder..................#21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31
Pancake Foundations..#21, 22, 23, 24, 25, 26, 27, 28, 29. 30. 31
Pancro Lining ....#21, 22
Pancro Lip Rouge.............# 7, 8, 9
Eyebrow Pencil ....Brown

for Color Photography

WOMEN

Blondes—Light Hair
Blue Eyes

Pancake ....Cream No. 2
Lipstick ....Vivid Red
Dry Rouge ....Blondeen
Face Powder ....Olive
Eye Shadow..................Blue No. 6
Eyelash Make-Up................Brown
Eyebrow Pencil ....Brown

Brunettes—Dark Hair
Brown or Dark Eyes

Pancake ....Tan No. 1
Lipstick ....Deep Red
Dry Rouge ....Carmine
Face Powder ....Olive
Eye Shadow..............Brown No. 2
Eyelash Make-Up ....Black
Eyebrow Pencil ....Black

MEN

Dark Complexions

Pancake ....Tan No. 2
Moist Rouge No. 4 (for lips)

Fair Complexions

Pancake ....Tan No. 1
Moist Rouge No. 4 (for lips)

HOUSE OF WESTMORE MAKE-UP CHART

BLACK AND WHITE PHOTOGRAPHY

NO CHEEK ROUGE is used in making up for black and white photography, either still or motion picture.

STILL PHOTOGRAPHY

The most important single make-up item, photographically speaking, is the base, and the color used is that ordinarily worn by the model for street. Exceptions are platinum or bleached blondes where skin and hair tones are so similar that definition is lacking; and brunettes, with olive skins, who pose the same problem.

In the case of the blondes, the foundation liquid or cream chosen should be at least two shades darker than that used for street; for brunettes, the shade chosen should be one shade lighter than that worn for street.

Women

Lining Color:	Studio Medium or Overglo Powder
Mascara:	Brown
Eyebrow Pencil:	Brown
Lip Rouge:	Brown
	One Shade Darker Than for Street

Men

(No make-up, except in the presence of a heavy beard, when Overglo liquid-cream foundation in matching skin tone is used over bearded area only.)

FOR CHILDREN, no make-up for still photography is recommended, since it destroys their natural charm.

BLACK AND WHITE: MOTION PICTURE

	Women		Men	
Base:	16	17	18	19
Highlights:	Blonde	Brunette	Blonde	Brunette
Powder:	11, 12, 15			
Lining:	Studio Medium or Overglo			
Lip Rouge:	Brown or Blue-Grey			
Eyebrow Pencil:	One Shade Darker Than for Street			

COLOR PHOTOGRAPHY

Make-up for women remains exactly the same as that used for street wear, with one notable difference: Lipstick, as well as cheek rouge, should be two shades lighter than that used for street, because the film accentuates the basic colors of red, blue and yellow. No make-up for men, with exception noted above.

Women

Blondes: Teck. No. 1, and corresponding rouges — Overglo powder only.

Brunettes: Teck. No. 2, and corresponding rouges — Brown eyeshadow, brown pencil only.

Men

Blonde or Brunette: Teck. No. 3, and Overglo powder; brown eyeshadow, brown pencil only.

EXPOSURE METERS

PHOTO ELECTRIC CELL TYPES

Name	F. Range	Exposure Range	American Scheiner and Other Range	Weston Speeds	Other Features
De Jur Critic 40	1.2 to 22	1 min. to 1/1000	6 to 128 Frames	2 to 800	Locking button for all film
Commander	1.5 to 32	100 sec. to 1/1200	In ⅓ Stops	1 to 800	Automatic scales, Photometric type
Hickok Duplex	1 to 32	3 sec to 1/1500	In ½ stops	0.5 to 560	Still or Movies
Electrophot 14A	1.4 to 32	2 sec. to 1/1000	14* to 35* Am. Sch.	3 to 400	Reads direct or conversion
Super Electrophot	1 to 32	1 min. 1/1000	11* to 36* Am. Sch.	1.5 to 400	Still or movies, day or mazda
General Electric	1 to 44	100 sec. to 1/2500	0.5 to 1700 ft. Candles	0 to 800	Still or movies, day or mazda
G. M. Standard	1.4 to 32	16 sec. to 1/1000	In ½ Stops	1 to 250	Still or movies, day or mazda
Norwood Three Dimensional	1.4 to 22	Motion Pictures or Stills	In ¼ stops at 1/50 second	1 to 800	Mazda, Arc or Daylight Individually Calibrated
Weston Master II	1.5 to 32	100 sec. to 1/1200	In ¼ stops	.1 to 1600	High & low light scales
Phaostron C	1.5 to 32	128 min. to 1/1200	In ⅓ Stops	1 to 800	Still or movies, Photometric type

EXPOSURE METERS

PHOTO ELECTRIC CELL TYPES

Name	F. Range	Exposure Range	American Scheiner and Other Range	Weston Speeds	Other Features
Photrix SS	1 to 36	60 sec. 1/2000	14* to 32* Am. Sch.	1.5 to 800	8 to 64 frames, day or mazda
Photrix Cine	1 to 32	Movie	8* to 38* Am. Sch.	0.5 to 800	6 to 128 frames, day or mazda
Sears Marvel	1.4 to 32	16 sec. to 1/1000	1.4 to 1000 ft. Candles	1 to 250	Still or movies, day or mazda
Sears Marvel Deluxe	1.5 to 64	2 min. to 1/1250	1 to 1650 ft. candles	1 to 800	Two scales for high & low intensities
Tempihot T30	1.5 to 25	240 sec. to 1/3000	17* to 32* Am. Sch.	Yes	Still or movies, day or mazda
Wards Supreme	1 to 32	60 sec. to 1/1000	In Full Stops	.3 to 200	Still or movies, day or mazda
Weston 715	1.5 to 32	100 sec. to 1/1200	In 1/3 Stops	.2 to 800	High & low scales
Weston 720	1 to 22	Movie	6 to 96 frames	1 to 800	Calibrated for movies only
Weston Jr.	2 to 32	64 sec. to 1/1000	In 1/2 Stops	2 to 500	Still or movies, day or mazda
Weston Jr. Cine 850	2 to 32	Movie		.3 to 800	Designed for Leica Camera
Leicameter	1.5 to 36	64 sec. to 1/1000	6 to 96 frames	2 to 250	For movie use only

EXPOSURE METERS

THEIR USE AND CHARACTERISTICS

The most worthwhile adjunct to either professional or amateur photography is a reliable exposure meter. While there are many excellent types including the sensitized paper, visual extinction, calculator, and photometric types, all of which require visual comparison of densities or brightness, the most uniformly dependable is the photo electric cell type, which gives an accurate, mechanical measurement of the light falling on its light-sensitive cell. Of these, the Weston, Norwood and General Electric are probably the type most generally used, though there are a number of other excellent photo electric cell meters, as shown in page 136, also those built into certain European cameras like the Zeiss Contax and Contaflex, the 16mm Siemens Halske and others.

The following data, while directly applicable to Weston meters, can in general be applied with few modifications to any other type of photo electric cell exposure meter. Virtually all photo electric meters are provided with an indicating dial upon which is read the brightness of the scene, usually in foot-candles, and a calculating dial by means of which this reading may be translated into terms of photographic exposure, an adjustment is provided by means of which the calculator may be set to read accurately for a film or plate of any speed.

The general operation of such a meter is:

1. Set the film speed to the value indicated for the film used.
2. Direct the meter at the scene or subject.
3. Note the brightness reading on the indicator dial.
4. Set the pointer on the calculator dial to the brightness value read on the indicator dial.
5. Thereafter the correct exposure may be read from the calculator for any given shutter-time or lens opening.

For still or miniature cameras, it is possible either to select a lens opening (stop) that will give the desired depth, and vary the shutter speed accordingly, or to choose a shutter speed that will stop the motion in the picture, and govern the lens setting by this. For instance, for a given brightness reading, settings of

F.11 at 1/25 second and F.8 at 1/50 second will give identical exposures; but the former will give greater depth, while the latter will arrest faster movement.

In using motion picture cameras other than those with adjustable shutter openings, the duration (shutter speed) of the exposure is fixed, and the lens opening must be set at a figure correct for that shutter speed. Shutter speeds of most 16mm cameras will be found on pages 164 to 175.

The most common error in using photo electric exposure meters is pointing the light sensitive cell at the scene wrongly, so that it gives an inaccurate reading. In general, the meter should be read on the most important object or part of the scene. For long shots, the meter reading should be taken a short distance in front of the camera position. For medium shots, the meter should be within four or five feet of the person or object photographed. For close-ups, the meter should be read within 1 foot of the subject's face.

In taking readings, particularly in longer shots, the meter should be pointed slightly downward, so as not to include too much sky, which would give an erroneous reading. It is always a good plan to shade the meter's "eye" as you would a camera lens. The direct rays of the sun must never be allowed to strike the meter's cell.

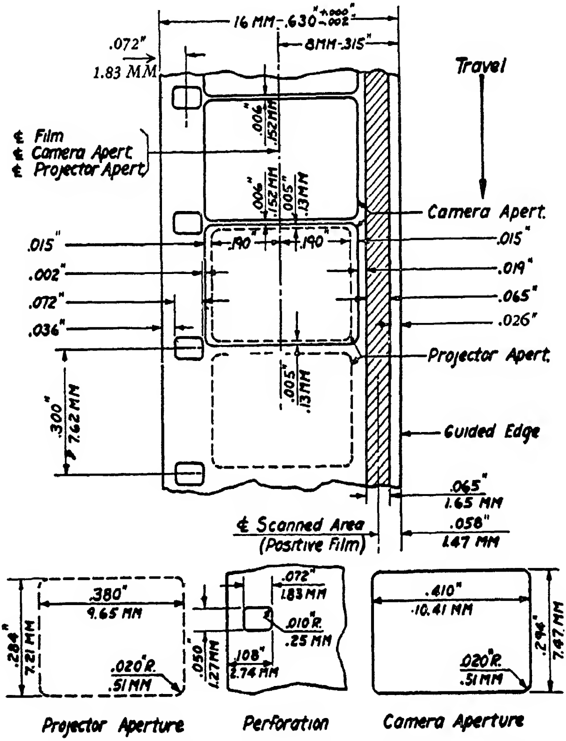
Where there is a dark foreground, secondary in importance to a more brilliant background, it is a good idea to walk well into the scene and take the reading where the meter will not be mislead by the darker foreground; if this is not possible, use the "A" (½ normal exposure) pointer on the calculator rather than the "B" (normal exposure) arrow. This pointer is also best for taking readings of extreme open long shots.

Professional cameramen in the Hollywood studios use the meter to measure the INCIDENT LIGHT, (light falling on the subject), with the meter pointed to the light. This method is very helpful in obtaining readings of low level lighting and should be used with the hood off.

STANDARD 16-MM. SOUND FILM

CAMERA APERTURE, PROJECTOR APERTURE, AND SCANNED AREA

These dimensions and locations are shown relative to unshrunk raw stock. Positive; emulsion side up. Negative; emulsion side down.



In the projector the base (not emulsion) side of the positive, made either by the reversal process or by optical printing from 35-mm. negatives, or from negatives produced by optical printing from 35-mm. film, faces the light source. Viewed from the light source, the sound track is to the left.

The emulsion side of the films used for color systems employing lenticulated film processes or screen-plate processes, and contact prints made from original 16-mm. negatives, must face the light source.

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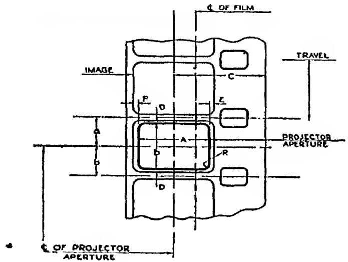
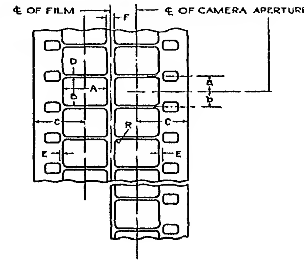
8 mm. STANDARDS

AMERICAN STANDARD For 8 mm Silent Motion Picture Film	ASA Z22.20 1941
PROJECTOR APERTURE	



	Millimeters	Inch Equivalents
A	4.37 ± 0.03	0.172 ± 0.001
B	3.28 ± 0.03	0.129 ± 0.001
C	5.33 ± 0.05	0.2055 ± 0.002
D	0.11	0.004
E	0.21	0.008
F	0.21	0.008
R	0.25	0.010
a = *b* = 1/2 longitudinal perforation pitch		

AMERICAN STANDARD For 8 mm Silent Motion Picture Film	ASA Z22.19 1941
CAMERA APERTURE	



	Millimeters	Inch Equivalents
A	4.80 ± 0.03	0.189 ± 0.001
B	3.51 ± 0.03	0.138 ± 0.001
C	5.22 ± 0.05	0.205 ± 0.002
D	0.30	0.012
E	0.08	0.003
F	0.76	0.030
R	0.25	0.010
a = *b* = 1/2 longitudinal perforation pitch		

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March, 1941—Pages 21, 22

EXPOSURE METER COMPENSATOR

METER READING FOR KEY LIGHT

Lens Stop	A	B	C	D	E	F	G	H	I	J	K	L
1.8	15	18	21	25	31	37	43	50	62	75	87	100
.2	18	21	25	31	37	43	50	62	75	87	100	125
2.1	21	25	31	37	43	50	62	75	87	100	125	150
2.3	25	31	37	43	50	62	75	87	100	125	150	175
2.5	31	37	43	50	62	75	87	100	125	150	175	200
2.8	37	43	50	62	75	87	100	125	150	175	200	250
3.	43	50	62	75	87	100	125	150	175	200	250	300
3.2	50	62	75	87	100	125	150	175	200	250	300	350
3 6	62	75	87	100	125	150	175	200	250	300	350	400
4.	75	87	100	125	150	175	200	250	300	350	400	500
4.2	87	100	125	150	175	200	250	300	350	400	500	600
4.5	100	125	150	175	200	250	300	350	400	500	600	700
5.	125	150	175	200	250	300	350	400	500	600	700	800
5.6	150	175	200	250	300	350	400	500	600	700	800	1000
6.	175	200	250	300	350	400	500	600	700	800	1000	1200
6.3	200	250	300	350	400	500	600	700	800	1000	1200	1400
7	250	300	350	400	500	600	700	800	1000	1200	1400	1600
8.	300	350	400	500	600	700	800	1000	1200	1400	1600	2000
8.5	350	400	500	600	700	800	1000	1200	1400	1600	2000	2400
9.1	400	500	600	700	800	1000	1200	1400	1600	2000	2400	2800
10.	500	600	700	800	1000	1200	1400	1600	2000	2400	2800	
11.	600	700	800	1000	1200	1400	1600	2000	2400	2800		
12.	700	800	1000	1200	1400	1600	200	2400	2800			
12.5	800	1000	1200	1400	1600	2000	2400	2800				
14.	1000	1200	1400	1600	2000	2400	2800					
16.	1200	1400	1600	2000	2400	2800						

EXPOSURE METER COMPENSATOR

METER READING FOR KEY LIGHT

Lens Stop	M	N	O	P	Q	R	S	T	U	V	W	X
1.8	125	150	175	200	250	300	350	400	500	600	700	800
2.	150	175	200	250	300	350	400	500	600	700	800	1000
2.1	175	200	250	300	350	400	500	600	700	800	1000	1200
2.3	200	250	300	350	400	500	600	700	800	1000	1200	1400
2.5	250	300	350	400	500	600	700	800	1000	1200	1400	1600
2.8	300	350	400	500	600	700	800	1000	1200	1400	1600	2000
3.	350	400	500	600	700	800	1000	1200	1400	1600	2000	2400
3.2	400	500	600	700	800	1000	1200	1400	1600	2000	2400	2800
3.6	500	600	700	800	1000	1200	1400	1600	2000	2400	2800	
4.	600	700	800	1000	1200	1400	1600	2000	2400	2800		
4.2	700	800	1000	1200	1400	1600	2000	2400	2800			
4.5	800	1000	1200	1400	1600	2000	2400	2800				
5.	1000	1200	1400	1600	2000	2400	2800					
5.6	1200	1400	1600	2000	2400	2800						
6.	1400	1600	2000	2400	2800							
6.3	1600	2000	2400	2800								
7.	2000	2400	2800									
8.	2400	2800										
8.5	2800											

The object of this chart is to determine the correct meter reading of key light to obtain equal negative density values for all lens stops.

First, you must pre determine which is the proper combination (lens stop and meter reading) for the type of negative preferred by your laboratory. Having found this,—note in which column the meter reading appears and then use only THAT column for all other readings.

Example:—(On opposite page) If F.2.8 at 125 foot candles is best for your laboratory, chart shows this combination (F.2.8 at right angle to 125 is found only in the "H" column, therefore, use only the "H" column for all your readings. F.2.8 at 125 will give the same density negatives as F.3.2 at 175—F.4 at 250—F.4.5 at 350—F.5.6 at 500, etc., etc.

Now suppose your laboratory prefers a stronger negative, such as F.2.3 at 150 foot candles, then this combination will be found in the "K" column and so all your readings should be in the "K" column. F.2.3 at 150 gives you the same density negatives as F.2.8 at 200—F.3.2 at 300—F.4 at 400, etc., etc.

CARE AND HANDLING OF FILM IN THE TROPICS

The dangerous element in the tropics is the combination of extreme heat and extreme humidity. Where the climate is hot but dry, the cinematographer's problem is reduced to the relatively simple one of protecting the film from direct sunlight and keeping it as cool as possible. Where there is both heat and humidity the film must be guarded against mildew which not only spoils the film for use but has a deteriorating effect on the unexposed emulsion.

When exposed film is kept for long periods in high temperatures a chemical fog is produced and in addition the latent image also deteriorated to such an extent that in many cases the image is hardly visible after development.

All film intended for use in the tropics, or to be transported through the tropics, should be bought in the special, hermetically sealed "Tropicak Packing." It is also wise to get the film in as short rolls as possible—i.e., 400 or even 200 feet rather than the usual 1000 foot rolls—so that only the footage necessary for any given day's shooting need be unpacked.

On the tropical location, care must be taken to keep all exposed and unexposed film in dry, cool storage and never in contact with damp ground or in places where the hot rays of the sun can beat upon its container.

Magazines should not be loaded until immediately before use. Loaded magazines should, if possible, be wrapped in waxed paper. Exposed film should be packed in dry black paper, without rewinding.

When loading and unloading magazines or film cans, care should be taken that perspiration does not fall on film or paper. It is well to wrap several layers of cheesecloth about the wrists and forehead to absorb perspiration when handling film in hot darkrooms. The hands kept dry by wiping them frequently.

Keep all camera accessories away from direct sun rays and other excessive heat. This is especially important as regards to lenses and filters, which can be ruined by heat or strong, direct sunlight.

Development should take place within six months after time of purchase.

Do not keep unexposed negatives for long periods at high temperatures.

After film has been exposed, it should be dehydrated or dessiccated (the moisture taken out) before it is canned and packed for shipment to the laboratory. Do not, however, dry the film to the point where it becomes excessively brittle. It may crack and break, and also develop static marks when unrolled.

There are two methods of dehydrating film, as follows:

1. Take black paper and dry it out thoroughly by heating it in an oven. Pack this loosely in a light-tight box, place loosely wound film in the center of the paper and allow it to remain overnight. The paper absorbs moisture from the film which should be packed immediately. The black paper used in dehydrating can be dried again and re-used.

2. Take a metal container partially filled with calcium chloride and place on the bottom of a large, light-tight and air-tight wooden box. Into this box place a large quantity of black paper and also the exposed film. Allow film and paper to remain in this dessiccating box for at least 24 hours, then wrap the film in the black paper and seal it in shipping cans. In using this method, care must be taken that neither the black paper nor the film comes in contact with the calcium chloride; otherwise the film will show spots that cannot be removed. The calcium chloride may be used many times before discarding.

After dehydrating by either method, the film should be immediately wrapped in dry black paper, and sealed in a dry film can. The film can taped as usual, and the tape then painted with warm paraffin to form an air-tight and moisture-tight seal. The Dupont Company have an excellent black lacquer that may be used for this purpose.
The can may be soldered, rather than taped, but care must be exercised to avoid heating the can and its contents in the soldering.

The black paper in which the film is wrapped on coming from the factory may be dried and re-used in packing exposed film, but it is always best to carry a generous extra supply of fresh black paper.

Never use newspaper or any kind of wrapping paper other than black photographic wrapping paper to repack film, as most paper contains chemicals which is very injurious to the sensitive emulsion.

Film should also be kept away from salt air, which has a tendency to fade exposed film and producing moisture spots

CARE AND HANDLING OF FILM IN THE ARCTIC

Before leaving the studio, assure yourself that your camera and its accessories are ready for operation in the extreme cold of the Arctic. Pre-calibrate the finder for all lenses and distances. If you know you can really trust your finder and lens calibrations, you will save a great deal of difficulty in racking your camera over for focus check-ups. This is particularly important if using a Bell & Howell camera with its necessity of sliding the camera and revolving the turret for focusing.

Remove all oil and grease from the camera and tripod head. In Arctic temperatures, oil and grease freeze and prevent proper operation of the camera, sometimes seriously injuring the delicate mechanism. In most cases, the contraction of the metal will give sufficiently increased clearance to permit the camera to operate without lubrication. If some lubrication is necessary, use kerosene or sperm oil.

Cinch marks and abrasion marks are short, narrow scratches on either the emulsion side or the celluloid side of the film and are caused by friction produced when adjacent layers of the film slip over one another or when an unevenly wound roll is flattened by pushing into place the protruding edges of the irregular layers or by tightening up a loosely wound roll. These can be avoided by very careful rewinding in an even, cold temperature.

Static markings are also a source of great annoyance and are generally caused by friction of the film coming in contact with the cold metal of the camera, particularly when film and camera are of different temperatures. Great care must therefor be taken to keep both camera and film in absolutely the same temperature and to prevent any condensation when loading or unloading or rewinding exposed or unexposed film.

Always keep both camera and film at outside temperature, no matter how cold. Avoid bringing camera or film from the outside cold into a warm room, as condensation takes place which takes a long time to dry. Lenses and filters may become fogged, while film becomes moist and on drying will stick together or develop static marks.

Be careful when rewinding film. With the cold, it often becomes very brittle and will tear or break with the slightest crease or fold. When the film is cold, the edges also be-

come very sharp, and unless care is exercised in handling, the film may cut your fingers badly.

Exposed film should be kept at outside temperature until ready for shipment.

Batteries should be protected from freezing. A frozen battery loses its voltage. To prevent this provide a separate box covered with skins or other heat insulators for each battery.

Motors also should be protected, heavy skins are used for that purpose. A cold motor does not run up to speed and its timing should be checked frequently.

Light is usually of tremendous brilliance in Arctic regions, and care should be taken to prevent over-exposure. The photographic value of Arctic light often deceives the eye, while in some regions magnetic and other conditions have affected the accuracy of exposure meters. The best practice in Arctic photography is to rely on hand tests. In this connection, an electric heating element connected to a battery will warm the developer and hypo used for making these tests.

It is wise to wear thin silk gloves under your heavy wool mittens. The gloves will keep your hands warmer, and when the heavy mittens are removed for work on the camera, the thin gloves will prevent your bare hands from coming into direct contact with the freezing metal. The slight protection given by the gloves will also give you more freedom in making precise adjustments of filters, lenses, and tripod, but be sure that your heavy wool mittens is sewed to a long cord which is carried around your neck, for should the mittens fall on the snow and become wet, they will freeze immediately and become useless.

A good plan to prevent the tripod from sinking in snow, is to have a canvas triangle made with brass eyelets for the tripod points. When using, the canvas triangle is spread on the snow, tripod points into the eyelets and in this manner your tripod will remain rigid.

A good practice to keep cameras in condition is to remove the lens and run the camera immersed in kerosene for about one half an hour.

Always keep the metal eyepiece of your camera covered with cloth, because if your eye comes in contact with the metal eyepiece you are liable to leave a portion of skin from your face there.

Keep all leather straps and leather cases away from the dogs or you will not have any left. Dogs like and eat this leather.

MINIATURE CAMERAS
USING 35 mm. FILM

No.	NAME	LENS			TYPE OF SHUTTER	EXPOSURE RANGE
		SPEED	SIZE	MAKE		
1	ANSCO MEMO........	F.3.5	2 in.	Anastigmat	Leaf	T.B. 1/2 sec. to 1/200 sec.
2	ANSCO MEMO........	F.3.5	2 in.	Anastigmat	Leaf	T.B. 1/2 sec. to 1/200 sec.
3	ARGUS A............	F.4.5	2 in.	Anastigmat	Between Lens	T.B. 1/25 sec. to 1/200 sec.
4	ARGUS C-3..........	F.3.5	50 mm.	Cintar	Behind Lens	T.B. 1/10 sec. to 1/300 sec.
5	ARGUS C-2..........	F.3.5	2 in.	Cintar	Behind Lens	T.B. 1/10 sec. to 1/300 sec.
6	ARGUS A-3..........	F.4	2 in.	Anastigmat	Argus	T.B. 1/25 sec. to 1/150 sec.
7	ARGUS C C..........	F.4	2 in.	Anastigmat	Argus	T.B. 1/25 sec. to 1/150 sec.
8	BALDINA SUPER......	F.2.9	Any	Trioplan	Rapid Compur	T.B. 1 sec. to 1/500 sec.
9	CLARUS MS 35........	F.2.8	2 in.	Busch	Focal Plane	T.B. 1/25 sec. to 1/500 sec.
10	CONTAX II...........	F.1.5	Any	Zeiss Sonnar	Focal Plane	T.B. 1/2 sec. to 1/1250 sec.
11	CONTAX III..........	F.1.5	Any	Zeiss Sonnar	Focal Plane	T.B. 1/2 sec. to 1/1250 sec.
12	CONTAFLEX..........	F.1.5	Any	Zeiss Sonnar	Focal Plane	T.B. 1/2 sec. to 1/1000 sec.
13	DEPTHRO-STERO.....	F.4.5	2-2 in.	Wollensak	Alphax	T.B. 1/25 sec. to 1/200 sec.
14	DOLLINA O..........	F.2.9	50 mm.	Certar	Compur B	T.B. 1 sec. to 1/300 sec.
15	DOLLINA II..........	F.2.8	50 mm.	Zeiss Tessar	Rapid Compur	T.B. 1 sec. to 1/500 sec.
16	DOLLINA SUPER......	F.2	50 mm.	Xenon	Rapid Compur	T.B. 1 sec. to 1/500 sec.
17	EXAKTA KINE........	F.2	Any	Hugo Meyer	Focal Plane	T.B. 12 sec. to 1/1000 sec.
18	JUBILETTE...........	F.2.9	50 mm.	TrioPlan	Compur	T.B. 1 sec. to 1/300 sec.
19	KODAK 35	F.3.5	50 mm.	Kodak	Kodamatic	T.B. 1/10 sec. to 1/200 sec.
20	KODAK 35 R. F.......	F.3.5	50 mm.	Kodak	Kodamatic	T.B. 1/10 sec. to 1/200 sec.
21	KODAK EKTRA.......	F.1.9	35-153 mm.	Kodak Ektar	Focal Plane	T.B. 1 sec. to 1/1000 sec.

MINIATURE CAMERAS (Continued)
USING 35 mm. FILM

No.	METHOD OF FOCUS	TYPE OF FINDER	Exposure LOADS	SPECIAL FEATURES
1	Helical Scale	Eye Level	24	Depth of field guide, exposure counter.
2	Helical Scale	Eye Level	48	Takes single frame, eveready case.
3	Semi-Fixed	Eye Level	36	Exposure counter, molded plastic.
4	Coupled Range Finder	Optical Eye Level	36	Built-in flash synchronizer, exposure counter.
5	Coupled Range Finder	Optical Eye Level	36	Screw type lens mount.
6	Helical Scale	Optical Eye Level	18–36	Built-in extinction exposure meter.
7	Helical Scale	Optical Eye Level	18–36	Built-in photo electric exposure meter.
8	Coupled Range Finder	Eye Level	36	Depth of focus guide.
9	Coupled Range Finder	Eye Level	18–36	Built-in flash synchronizer, automatic film transport.
10	Coupled Range Finder	Direct View Eye Level	36	Adaptable to cut film or plates, bayonet type mount.
11	Coupled Range Finder	Direct View Eye Level	36	Built-in electric photo exposure meter.
12	Mirror Reflex	Eye or Waist Level	36	Built-in exposure meter, depth of focus guide.
13	Fixed Focus	Eye Level	12	Built-in flash synchronizer, exposure counter.
14	Lens Scale	Optical Tabular	36	Automatic counting and film locking device.
15	Split Image Range Finder	Built-in Optical	36	Depth of focus table, focuses to three feet.
16	Coupled Range Finder	Built-in Optical	36	Film locking device prevents double exposures.
17	Reflecting Lens	Mirror Reflex	36	Hyperfocal distance table, built-in synchronizer.
18	Helical Scale	Tubular Eye Level	36	Automatic film placement and shutter lock.
19	Manual Focus	Folding Eye Level	18–36	Exposure counter, delayed action. Automatic Film Stop double exposure prevention.
20	Coupled Range Finder	Optical Eye Level	18–36	Shutter set and film advanced simultaneously.
21	Coupled Range Finder	Optical Eye Level	18–36	Parallax corrected finder, surface treated lenses. Interchangable magazine back.

MINIATURE CAMERAS
USING 35 mm. FILM

No.	NAME	LENS			TYPE OF SHUTTER	EXPOSURE RANGE
		SPEED	SIZE	MAKE		
22	LEICA STANDARD....	F.3.5	Any	Leitz	Focal Plane	T.B. 1/20 sec. to 1/500 sec.
23	LEICA II..............	F.3.5	Any	Leitz	Focal Plane	T.B. 1/20 sec. to 1/500 sec.
24	LEICA III.............	F.2	Any	Leitz	Focal Plane	T.B. 1/20 sec. to 1/500 sec.
25	LEICA III B..........	F.1.5	Any	Leitz	Focal Plane	T.B. 1 sec. to 1/1000 sec.
26	LEICA 250............	F.2	Any	Leitz	Focal Plane	T.B. 1 sec. to 1/1000 sec.
27	MAGIC EYE..........	F.2	1-24 in.	Any	Adjustable	1/35 sec. to 1/4000 sec.
28	PERFEX 22...........	F.3.5	2 in.	Scienar	Focal Plane	T.B. 1 sec. to 1/1250 sec.
29	PERFEX 55...........	F.2	2 in.	Wollensak	Focal Plane	T.B. 1 sec. to 1/1250 sec.
30	PRAKTIFLEX.........	F.2	5 cm.	Xenon	Focal Plane	T.B. 1/20 sec. to 1/500 sec.
31	ROBOT 1..............	F.2.8	30 mm.	Tessar	Disc	T.B. 1 sec. to 1/500 sec.
32	ROBOT 2..............	F.2	40 mm.	Biotar	Disc	T.B. 1/2 sec. to 1/500 sec.
33	ROLLEICORD.........	F.3.5	7.5 cm.	Triotar	Compur	T.B. 1 sec. to 1/300 sec.
34	ROLLEIFLEX.........	F.3.5	7.5 cm.	Tessar	Rapid Compur	T.B. 1 sec. to 1/500 sec.
35	TENAX I..............	F.3.5	35 mm.	Novar	Compur	T.B. 1 sec. to 1/300 sec.
36	TENAX II.............	F.2	50 mm.	Sonnar	Rapid Compur	T.B. 1 sec. to 1/400 sec.
37	UNIVEX CORSAIR....	F.4.5	50 mm.	Anastigmat	Between Lens	T.B. 1/25 sec. to 1/200 sec.
38	UNIVEX MERCURY...	F.3.5	35 mm.	Wollensak	Focal Plane	T.B. 1/20 sec. to 1/1000 sec.
39	WELTI	F.2	2 in.	Biotar	Rapid Compur	T.B. 1 sec. to 1/500 sec.
40	WELTINI..............	F.2.8	2 in.	Tessar	Rapid Compur	T.B. 1 sec. to 1/500 sec.
41	WATSON..............	F.2	2 in.	Biotar	Rapid Compur	T.B. 1 sec. to 1/500 sec.
42	MERCURY II.........	F.2.7	35 mm.	Tricor	Focal Plane	T B. 1/20 sec. to 1/1000 sec.
43	STERO REALIST......	F.3.5	35 mm.	Ilex-Paragon	Behind-the-lens	T.B. 1 sec. to 1/150 sec.
44	VOKAR 1..............	F.2.8	2 in.	Vokar	Focal Plane	T.B. 1 sec. to 1/300 sec.

MINIATURE CAMERAS (Continued)
USING 35 mm. FILM

No.	METHOD OF FOCUS	TYPE OF FINDER	Exposure LOADS	SPECIAL FEATURES
22	Helical Scale	Eye Level	36	Detachable range finder, exposure counter.
23	Coupled Range Finder	Direct View Eye Level	36	Depth of focus guide, screw mount interchangeable lenses.
24	Coupled Range Finder	Direct View Eye Level	36	Takes all Leica accessories.
25	Coupled Range Finder	Direct View Eye Level	36	This model comes in chrome finish only.
26	Coupled Range Finder	Direct View Eye Level	250	Special magazine holds 250 exposure loads.
27	Ground Glass	Optical Matched	1600	800 single frame exposures with one winding.
28	Coupled Range Finder	Eye Level	36	Built-in extinction type exposure meter.
29	Coupled Range Finder	Eye Level	36	Built-in flash synchronizer, E.
30	Mirror Reflex	Eye or Waist Level	18-36	Adjustable slit curtain, automatic exposure counter.
31	Zone-Focusing	Monochromatic	48	Hyperfocal table, 24 exposures in rapid succession.
32	Zone-Focusing	Monochromatic	48	Built-in flash synchronizer, depth of focus guide.
33	2 Lens Reflex	Eye and Waist Level		Adaptor for 35 mm. film, automatic film transport.
34	2 Lens Reflex	Eye and Waist Level		Adaptor for 35 mm. film, parallax adjustment.
35	Scale	Folding Eye Level	50	Shutter and film advance simultaneously.
36	Coupled Range Finder	Eye Level	50	Bayonet lens mount, exposure counter.
37	Helical Scale	Optical Eye Level	20	Built-in extinction meter and flash synchronizer.
38	Helical Scale	Direct View Eye Level	18-36	Depth of focus table, parallax adjustment, flash unit.
39	Scale	Eye Level	36	Parallax adjustment, depth of focus guide.
40	Coupled Range Finder	Eye Level	36	Exposure counter, parallax adjustment.
41	Scale	Eye Level	36	Shutter release built in body.
42	Helical Scale	Optical Eye Level	65	Built-in Exposure Calculator.
43	Coupled Range Finder	Optical Matched	20-36	Built-in Flash Synchronizer
44	Coupled Range Finder	Eye Level	36	Automatic film advance and shutter set.

ANSCO MOTION PICTURE FILM

35mm FOR MINIATURE CAMERAS

NAME	TYPE	USE	CHARACTERISTICS	AVAILABLE IN	SPEED WESTON		SPEED G. E.	
					Day	Tung.	Day	Tung.
ULTRA SPEED PAN	Neg.	Studio Interiors — News Reel, Slow Motion, Adverse light conditions	Extreme speed, Normal grain, Full color sensitivity	36 exp. magazines, 27½′ and 100′ rolls	128	80	200	128
SUPREME	Neg.	General production work, All classes of photography	High speed, Fine grain, Full color sensitivity	36 exp. magazines, 27½″ and 100′ rolls	64	40	100	64
ANSCO COLOR	Rev. Color	Making Positive color transparencies	Natural color film	20 exp. magazines	10	10	16	16

These speed numbers will give density of negatives preferred for enlargements.

DUPONT MOTION PICTURE FILMS

35mm FOR MINIATURE CAMERAS

NAME	USE	CHARACTERISTICS	AVAILABLE IN	SPEED: WESTON		SPEED: G. E.	
				Day	Tung.	Day	Tung.
SUPERIOR 1	General exterior photographic work	Extreme fine grain normal contrast	Bulk of 100 to 1000 feet rolls	8	6	12	10
SUPERIOR 2	For interior and all around work	High speed, wide latitude, high tungsten sensitivity	36 exposure magazines for Leica, Argus and other 35mm cameras, frame numbered, bulk	50	40	80	64
SUPERIOR 3	For poor lighting conditions, night shooting	Extreme speed, high sensitivity to red and yellow. Normal grain	Same as Superior 2	80	64	128	100
SAFETY MICROCOPY NEGATIVE	For copy work of all kind	Fine grain, special panchromatic color, response	Same as above, perf. and unperf.		*3.5		*5
INFRA D	"Night effects" in sunlight—Haze cutting, aerial work	Normal speed, fine grain, sensitive to blue, red, and near infra-red light	Bulk only	†16		†24	

*For line work.
†Without filter.

EASTMAN MOTION PICTURE FILMS

35mm FOR MINIATURE CAMERAS

NAME	USE	CHARACTERISTICS	AVAILABLE IN	SPEED WESTON Sun.	SPEED WESTON Tung.	SPEED G. E. Sun.	SPEED G. E. Tung.
KODAK SUPER XX	For use under adverse light conditions—High speed work	Extremely high speed, full color sensitivity	18 and 36 Exposure Magazines for Kodak 35, Retina, Contax and Leica. Also 27½, 50, 100 and 200 ft. rolls	80	50	128	80
KODAK PLUS X	General miniature Camera work	High speed, fine grain Full color sensitivity	Same as above	40	24	64	40
PANATOMIC X	For great enlargement and extreme detail	Moderate speed, extremely fine grain	Same as above	24	16	40	24
INFRA-RED	Night effects in sunlight—long distance and aerial photography	Sensitive to infra-red and also to blue, violet, red and orange filters to be used	36 Exposure Magazines; also 50 ft. rolls		3		5
KODACHROME A	Color photography with artificial light	Color balanced for photoflood lamps	18 Exposure Magazines	8	12	12	20
KODACHROME DAYLIGHT	Color photography in daylight	Color balanced for sunlight	18 Exposure Magazines	8	3	12	5

COPYING, REDUCING AND CLOSE-UP CHART

SHOWING DISTANCE BETWEEN LENS AND SUBJECT AND DISTANCE BETWEEN LENS AND SENSITIVE SURFACE.
(BELLOWS EXTENSION OR TUBES NECESSARY.)

Times of Reduction	2 IN. LENS DISTANCE		3 IN. LENS DISTANCE		4 IN. LENS DISTANCE		5 IN. LENS DISTANCE		6 IN. LENS DISTANCE	
	Lens to Subject	Lens to Film	Lens to Subject	Lens to Film	Lens to Subject	Lens to Film	Lens to Subject	Lens to Film	Lens to Subject	Lens to Film
1	4 In.	4 In.	6 In.	6 In.	8 In.	8 In.	10 In.	10 In.	12 In.	12 In.
2	3 In.	6 In.	4 1/2 In.	9 In.	6 In.	12 In.	7 1/2 In.	15 In.	9 In.	18 In.
3	2 2/3 In.	8 In.	4 In.	12 In.	5 1/3 In.	16 In.	6 2/3 In.	20 In.	8 In.	24 In.
4	2 1/2 In.	10 In.	3 3/4 In.	15 In.	5 In.	20 In.	6 1/4 In.	25 In.	7 1/2 In.	30 In.
5	2 2/5 In.	12 In.	3 3/5 In.	18 In.	4 4/5 In.	24 In.	6 In.	30 In.	7 1/5 In.	36 In.
6	2 1/3 In.	14 In.	3 1/2 In.	21 In.	4 2/3 In.	28 In.	5 5/6 In.	35 In.	7 In.	42 In.
7	2 2/7 In.	16 In.	3 3/7 In.	24 In.	4 4/7 In.	32 In.	5 5/7 In.	40 In.	6 6/7 In.	48 In.
8	2 1/4 In.	18 In.	3 3/8 In.	27 In.	4 1/2 In.	36 In.	5 5/8 In.	45 In.	6 3/4 In.	54 In.
9	2 2/9 In.	20 In.	3 1/3 In.	30 In.	4 4/9 In.	40 In.	5 5/9 In.	50 In.	6 2/3 In.	60 In.
10	2 1/5 In.	22 In.	3 3/10 In.	33 In.	4 2/5 In.	44 In.	5 1/2 In.	55 In.	6 3/5 In.	66 In.

MINIATURE CAMERA—Exposure Calculator

Parts of A Second	LENS STOP AND SHUTTER EQUALIZER																										
1/1000														F.	1.4	1.8	2	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11
1/750													F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5
1/500												F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.
1/375											F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.
1/250										F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.
1/185									F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.
1/125								F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.
1/95							F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.
1/65						F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.
1/50					F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.
1/30				F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.	
1/25			F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.		
1/15		F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.			
1/12	F.	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.				
1/8	1.4	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.					
1/6	1.8	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.						
1/4	2.	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.							
1/3	2.3	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.								
1/2	2.8	3.2	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.									
1 Sec.	4.	4.5	5.6	6.3	8.	9.1	11.	12.5	16.	18.	22.	25.	32.	36.	45.	64.											

EXAMPLE—1/1000 sec. at F.2 is equal to 1/500 sec. at F. 2.8
1/50 sec. at F.4 is equal to 1/25 sec at F. 5.6

MINIATURE CAMERA

FILTER COMPENSATOR
DIAPHRAGM EXPOSURE WITH VARIOUS FACTORS

FILTER FACTOR NUMBERS

Exposure With Filter

Exposure Without Filter	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	8	10	12	14	16	18	20	22	24
F. 2.3	F.2.																		
2.8	2.3	F.2.																	
3.2	2.8	2.3	F.2.2	F.2.															
4.	3.2	2.8	2.5	2.3	F.2.2	F.2.													
4.5	4.	3.2	3.	2.8	2.5	2.3	F.2.2	F.2.2	F.2.1	F.2									
5.6	4.5	4.	3.6	3.2	3.	2.8	2.7	2.5	2.4	2.3	F.2.								
6.3	5.6	4.5	4.3	4.	3.5	3.2	3.1	3.	2.9	2.8	2.3	F.2.2	F.2.						
8.	6.3	5.6	5.1	4.5	4.3	4.	3.8	3.6	3.4	3.2	2.8	2.5	2.3	2.2	F.2.				
9.1	8.	6.3	5.9	5.6	5.1	4.5	4.4	4.3	4.2	4.	3.2	3.	2.8	2.5	2.3	2 2	F.2.		
11.	9.1	8.	7.2	6.3	5.9	5.6	5.4	5.1	4.8	4.5	4.	3.6	3.2	3.	2.8	2.5	2.3	2.2	F.2.
12.5	11.	9.1	8.5	8.	7.2	6.3	6 1	5.9	5 8	5.6	4.5	4 3	4.	3.5	3.2	3.	2.8	2.5	2.3
16.	12.5	11.	10.1	9.1	8.5	8.	7.6	7.2	6.8	6.3	5.6	5.1	4.5	4.3	4.	3.6	3.2	3.	2.8
18.	16.	12.5	11.8	11.	10.1	9.1	8.8	8.5	8.3	8.	6.3	5 9	5 6	5 1	4.5	4 3	4.	3.5	3:2
22.	18.	16.	14.3	12.5	11.8	11.	10.6	10.1	9.7	9.1	8.	7.2	6.3	5.9	5.6	5.1	4.5	4.3	4.
25.	22.	18.	17.	16.	14.3	12.5	12.	11.8	11.5	11.	9.1	8.5	8	7.2	6.3	5.9	5.6	5.1	4.5
32.	25.	22.	20.	18.	17.	16.	15.	14.	13.2	12 5	11.	10.1	9.1	8.5	8.	7.2	6.3	5.9	5.6

CAMERA SPEED NORMAL—SHUTTER OPENING CONSTANT

FILTER FACTOR COMPENSATOR

For Miniature and Still Cameras

Shutter Exposure with Various Filters

Filter Factor Numbers

Exposure Without Filter	1.5	2	3	4	5	6	8	10
PARTS OF A SECOND	EXPOSURE WITH FILTER							
1/1000	1/750	1/500	1/335	1/250	1/200	1/165	1/125	1/100
1/750	1/500	1/375	1/250	1/185	1/150	1/125	1/95	1/75
1/500	1/375	1/250	1/165	1/125	1/100	1/85	1/65	1/50
1/350	1/260	1/175	1/115	1/85	1/70	1/60	1/45	1/35
1/250	1/190	1/125	1/85	1/65	1/50	1/40	1/35	1/25
1/200	1/150	1/100	1/65	1/50	1/40	1/35	1/25	1/20
1/150	1/115	1/75	1/50	1/40	1/30	1/25	1/20	1/15
1/125	1/95	1/65	1/40	1/30	1/25	1/20	1/15	1/12
1/100	1/75	1/50	1/35	1/25	1/20	1/15	1/12	1/10
1/75	1/60	1/40	1/25	1/20	1/15	1/12	1/10	1/8
1/60	1/45	1/30	1/20	1/15	1/12	1/10	1/8	1/6
1/50	1/40	1/25	1/18	1/12	1/10	1/8	1/6	1/5
1/40	1/30	1/20	1/15	1/10	1/8	1/7	1/5	1/4
1/35	1/30	1/18	1/12	1/9	1/7	1/6	1/4	1/3
1/30	1/25	1/15	1/10	1/8	1/6	1/5	1/4	1/3
1/25	1/20	1/12	1/8	1/6	1/5	1/4	1/3	2/5
1/20	1/15	1/10	1/7	1/5	1/4	1/3	2/5	1/2
1/15	1/10	1/8	1/5	1/4	1/3	2/5	1/2	2/3
1/10	1/8	1/5	3/10	2/5	1/2	3/5	4/5	1 Sec.
1/5	3/10	2/5	3/5	4/5	1 Sec	1 1/5 Sec.	1 3/5 Sec.	2 Sec.
1/4	3/8	1/2	3/4	1 Sec.	1 1/4	1 1/2 Sec.	2 Sec.	2 1/2 Sec.
1/2	3/4	1 Sec.	1 1/2 Sec.	2 Sec.	2 1/2 Sec.	3 Sec.	4 Sec.	5 Sec.
1 Sec.	1 1/2 Sec.	2 Sec.	3 Sec.	4 Sec.	5 Sec.	6 Sec.	8 Sec.	10 Sec.

DIAPHRAGM OPENING CONSTANT

FILTER FACTOR COMPENSATOR

For Miniature and Still Cameras

Shutter Exposure with Various Filters

Filter Factor Numbers

Exposure Without Filter	12	14	16	20	25	30	40	50
PARTS OF A SECOND	EXPOSURE WITH FILTER							
1/1000	1/85	1/70	1/65	1/50	1/40	1/35	1/25	1/20
1/750	1/65	1/55	1/45	1/40	1/30	1/25	1/20	1/15
1/500	1/40	1/35	1/30	1/25	1/20	1/15	1/12	1/10
1/350	1/30	1/25	1/20	1/18	1/15	1/10	1/8	1/7
1/250	1/20	1/18	1/15	1/12	1/10	1/8	1/6	1/5
1/200	1/15	1/15	1/12	1/10	1/8	1/6	1/5	1/4
1/150	1/12	1/10	1/10	1/8	1/6	1/5	1/4	1/3
1/125	1/10	1/8	1/8	1/6	1/5	1/4	1/3	2/5
1/100	1/8	1/7	1/6	1/5	1/4	1/3	2/5	1/2
1/75	1/6	1/5	1/5	1/4	1/3	2/5	1/4	2/3
1/60	1/5	1/4	1/4	1/3	2/5	1/2	2/3	5/6
1/50	1/4	1/3	1/3	2/5	1/2	3/5	4/5	1 Sec
1/40	1/3	1/3	2/5	1/2	5/8	3/4	1 Sec.	1 1/4 Sec.
1/35	1/3	1/2	1/2	1/2	5/7	7/8	1 1/8 Sec.	1 1/2 Sec.
1/30	2/5	1/2	1/2	2/3	5/6	1 Sec.	1 1/3 Sec.	1 2/3 Sec.
1/25	1/2	3/5	3/5	4/5	1 Sec.	1 1/6 Sec.	1 3/8 Sec.	2 Sec.
1/20	3/5	3/4	4/5	1 Sec.	1 1/4 Sec.	1 2/3 Sec.	2 Sec.	2 1/2 Sec.
1/15	1 Sec.	1 Sec.	1 Sec.	1 1/3 Sec.	1 2/3 Sec.	2 Sec.	2 1/4 Sec.	3 1/3 Sec.
1/10	1 1/5 Sec.	1 2/5 Sec.	1 2/5 Sec.	2 Sec.	2 1/2 Sec.	3 Sec.	4 Sec.	5 Sec.
1/5	2 2/5 Sec.	3 Sec.	3 1/5 Sec.	4 Sec.	5 Sec.	6 Sec.	8 Sec.	10 Sec.
1/4	3 Sec.	3 1/2 Sec.	4 Sec.	5 Sec.	6 1/4 Sec.	7 1/2 Sec.	10 Sec.	12 1/2 Sec.
1/2	6 Sec.	7 Sec.	8 Sec.	10 Sec.	12 1/2 Sec.	15 Sec.	20 Sec.	25 Sec.
1 Sec.	12 Sec.	14 Sec.	16 Sec.	20 Sec.	25 Sec.	30 Sec.	40 Sec.	50 Sec.

DIAPHRAGM OPENING CONSTANT

CLOSE-UP DIAPHRAGM CALCULATOR

2 INCH LENS

DISTANCE OF LENS TO OBJECT

LIGHT VALVE		30 in.	18 in.	12 in.	10 in.	8 in.	7 in.	6 in.	4 in.	3½ in.	3 in.
		EFFECTIVE APERTURE									
F.2	Becomes →	F. 2.2	F. 2.3	F. 2.4	F. 2.5	F. 2.6	F. 2.8	F. 3.2	F. 4	F. 4.5	F. 6.3
2.8	Becomes →	3	3.2	3.5	3.6	3.7	4	4.5	5.6	6.3	9
4	Becomes →	4.3	4.4	4.5	5	5.1	5.6	6.3	8	9	12
5.6	Becomes →	6	6.1	6.3	7	7.2	8	9	11	12	18
8	Becomes →	8.5	9	9.5	10	10.2	11	12	16	18	25
11	Becomes →	12	12.5	12.7	14	15	16	18	22	25	36
16	Becomes →	17	18	19	20	20.3	22	25	32	36	
22	Becomes →	24	24.4	25	26	27	32	36	45		
		DISTANCE OF LENS TO FILM									
		2⅛ in.	2¼ in.	2⅜ in.	2½ in.	2⅝ in.	2¾ in.	3 in.	4 in.	5 in.	6 in.

These charts are intended to be used more for guidance rather than accuracy, but show a quick method of determining the changes in effective aperture from the measured light value when photographing small objects at close distances from the camera. Lens diaphragms are marked in F. stop numbers when focused at infinity and there is

CLOSE-UP DIAPHRAGM CALCULATOR

3 INCH LENS

DISTANCE OF LENS TO OBJECT

LIGHT VALUE		20 in.	10 in.	7 in.	6 in.	5 in.	4½ in.	4 in.	3¾ in.	3½ in.	3¼ in.
		EFFECTIVE APERTURE									
F. 2	Becomes →	F. 2.3	F. 2.8	F. 3.2	F. 4	F. 4.5	F. 5.6	F. 8	F. 11	F. 12	F. 16
2.8	Becomes →	3.2	4	4.5	5.6	6.3	8	11	16	18	22
4	Becomes →	4.5	5.6	6.3	8	9.1	11	16	22	25	32
5.6	Becomes →	6.3	8	9.1	11	12	16	22	32	36	45
8	Becomes →	91	11	12	16	18	22	32	45		
11	Becomes →	12	16	18	22	25	32	45			
16	Becomes →	18	22	25	32	36	45				
22	Becomes →	25	32	36	45						
		DISTANCE OF LENS TO FILM									
		3¼ in.	4½ in.	5 in.	6 in.	8 in.	9 in.	12 in.	16 in.	20 in.	24 in.

no apparent change in the F. values when the camera is at least ten times the focal length of the lens away from the object, but as the camera distances to the object decreases and the camera extension increases, it greatly affects the F. value, since less light reaches the film.

CLOSE-UP DIAPHRAGM CALCULATOR

4 INCH LENS

DISTANCE OF LENS TO OBJECT

LIGHT VALUE		25 in.	15 in.	10 in.	8 in.	7 in.	6 in.	5½ in.	5 in.	4½ in.	4 in.
		EFFECTIVE APERTURE									
F. 2	Becomes →	F. 2.3	F. 2.8	F. 3.2	F. 4	F. 4.5	F. 5.6	F. 8	F. 11	F. 16	F. 22
2.8	Becomes →	3.2	4	4.5	5.6	6.3	8	11	16	22	32
4	Becomes →	4.5	5.6	6.3	8	9	11	16	22	32	45
5.6	Becomes →	6.3	8	9	11	12	16	22	32	45	64
8	Becomes →	9	11	12	16	18	22	32	45	64	
11	Becomes →	12	16	18	22	25	32	45	64		
16	Becomes →	18	22	25	32	36	45	64			
22	Becomes →	25	32	36	45	50	64				
		DISTANCE OF LENS TO FILM									
		5 in.	6 in.	7½ in	8 in.	11 in.	12 in.	14 in.	20 in.	32 in.	40 in.

A lens marked F.5.6 for infinity actually works at F.8 for photos in natural size because while the aperture remains the same, the distance of the lens to the film is doubled, thereby requiring longer exposure. It is also well

CLOSE-UP DIAPHRAGM CALCULATOR

5¼ IN. LENS

DISTANCE OF LENS TO OBJECT

LIGHT VALUE		40 in.	20 in.	15 in.	12 in.	10 in.	8½ in.	8 in.	7½ in.	7 in.	6½ in.
		EFFECTIVE APERTURE									
F. 2	Becomes →	F. 2.3	F. 2.8	F. 3.2	F. 3.6	F. 4	F. 4.5	F. 5.6	F. 6.3	F. 8	F. 9
2.8	Becomes →	3.2	4	4.5	5	5.6	6.3	8	9	11	12
4	Becomes →	4.5	5.6	6.3	7.2	8	9	11	12	16	18
5.6	Becomes →	6.3	8	9	10	11	12	16	18	22	25
8	Becomes →	9	11	12	14	16	18	22	25	32	36
11	Becomes →	12	16	18	20	22	25	32	36		
16	Becomes →	18	22	25	28	32	36				
22	Becomes →	25	32	36	40						
		DISTANCE OF LENS TO FILM									
		6 in.	7 in.	8 in.	9 in.	11 in.	12½ in.	14 in.	16 in.	20 in.	26 in.

to remember that at very close distances, the depth of focus greatly decreases, and depth of focus charts do not apply to these tables.

MINIATURE CAMERA

SHUTTER SPEED TO STOP ACTION OF MOVING OBJECTS

SUBJECTS	APPROX. SPEED	Distance from Camera	DIRECTION OF MOTION: NORMAL FOCUS LENSES: TOWARD CAMERA	NORMAL FOCUS LENSES: ANGLE CAMERA	NORMAL FOCUS LENSES: ACROSS CAMERA	LONG FOCUS LENSES: TOWARD CAMERA	LONG FOCUS LENSES: ANGLE CAMERA	LONG FOCUS LENSES: ACROSS CAMERA
Pedestrians, Dogs, Children Playing, Slow Moving Action	5 to 10 mi. per hr.	25 ft. 50 ft. 100 ft.	1/50 sec. 1/35 sec. 1/20 sec.	1/75 sec. 1/50 sec. 1/35 sec.	1/100 sec. 1/75 sec. 1/50 sec	1/75 sec. 1/50 sec. 1/35 sec.	1/100 sec. 1/75 sec. 1/50 sec.	1/150 sec. 1/100 sec. 1/75 sec.
Vehicles, Animals, Swimmers, General Street Traffic	10 to 20 mi. per hr.	25 ft. 50 ft. 100 ft.	1/100 sec. 1/50 sec. 1/35 sec.	1/50 sec. 1/75 sec. 1/50 sec.	1/200 sec. 1/125 sec. 1/100 sec.	1/125 sec. 1/75 sec. 1/50 sec.	1/200 sec. 1/125 sec. 1/75 sec.	1/300 sec. 1/200 sec. 1/125 sec.
Baseball, Football, Tennis, Skaters, Footracers, Polo.	20 to 30 mi. per hr.	25 ft. 50 ft. 100 ft.	1/125 sec. 1/75 sec. 1/50 sec.	1/200 sec. 1/125 sec. 1/75 sec.	1/300 sec. 1/200 sec. 1/125 sec.	1/200 sec. 1/125 sec. 1/75 sec.	1/300 sec. 1/200 sec. 1/125 sec.	1/500 sec. 1/300 sec. 1/200 sec.
Speed Boats, Horse Racing, Motorcycles.	30 to 45 mi. per hr.	50 ft. to 100 ft.	1/200 sec.	1/350 sec.	1/600 sec.	1/300 sec.	1/500 sec.	1/800 sec.
Fast Trains, Auto Races, Flying Birds, Aeroplanes.	45 to 100 mi. per hr.	100 ft. and Over	1/300 sec.	1/500 sec.	1/750 sec.	1/400 sec.	1/750 sec.	1/1000 sec.

NOTE: Normal Focus Lenses are up to 4 inch.

MINIATURE CAMERA
TABLE OF DISTANCES FOR MAKING ENLARGEMENTS

Times of En-large-ment	2 IN. LENS DISTANCE		3 IN. LENS DISTANCE		4 IN. LENS DISTANCE		6 IN. LENS DISTANCE		8 IN. LENS DISTANCE	
	Lens to Negative	Lens to Paper	Lens to Negative	Lens to Paper	Lens to Negative	Lens to Paper	Lens to Negative	Lens to Paper	Lens to Negative	Lens to Paper
1	4 In.	4 In.	6 In.	6 In.	8 In.	8 In.	12 In.	12 In.	16 In.	16 In.
2	3 In.	6 In.	4 1/2 In.	9 In.	6 In.	12 In.	9 In.	18 In.	12 In.	24 In.
3	2 2/3 In.	8 In.	4 In.	12 In.	5 1/3 In.	16 In.	8 In.	24 In.	10 2/3 In.	32 In.
4	2 1/2 In.	10 In.	3 3/4 In.	15 In.	5 In.	20 In.	7 1/2 In.	30 In.	10 In.	40 In.
5	2 2/5 In.	12 In.	3 3/5 In.	18 In.	4 4/5 In.	24 In.	7 1/5 In.	36 In.	9 3/5 In.	48 In.
6	2 1/3 In.	14 In.	3 1/2 In.	21 In.	4 2/3 In.	28 In.	7 In.	42 In.	9 1/3 In.	56 In.
7	2 2/7 In.	16 In.	3 3/7 In.	24 In.	4 4/7 In.	32 In.	6 6/7 In.	48 In.	9 1/7 In.	64 In.
8	2 1/4 In.	18 In.	3 3/8 In.	27 In.	4 1/2 In.	36 In.	6 3/4 In.	54 In.	9 In.	72 In.
9	2 2/9 In.	20 In.	3 1/3 In.	30 In.	4 4/9 In.	40 In.	6 2/3 In.	60 In.	8 8/9 In.	80 In.
10	2 1/5 In.	22 In.	3 3/10In.	33 In.	4 2/5 In.	44 In.	6 3/5 In.	66 In.	8 4/5 In.	88 In.

The above table shows the distances between the lens and negative (left side of column) and the distances between the lens and enlarging paper (right side of column).

STILL PROJECTORS
AND THEIR CHARACTERISTICS

No.	NAME	Accommodates			LAMP WATTAGE	LENS		TYPE OF FOCUS	COOLING UNIT
		3¼x4	2x2	35mm		Speed	SIZE		
1	BAUSCH & LOMB 2x2		X		150W	F.3.8	5 in.	Sliding	Convection
2	B & L BALOPTICON B	X			500W		2 to 24 in.	Rack & Pinion	Convection
3	B & L BALOPTICON BOH	X			500W	F.3	5½ to 6½	Rack & Pinion	Convection
4	B & L BALOPTICON CL	X			1000W		8 to 24 in.	Rack & Pinion	Convection
5	B & L BALOPTICON LRM	X			500W		7 or 10 in.	Sliding	Built-in Blower
6	B & L BALOPTICON ERM	X			500W		14 or 18 in.	Sliding	Built-in Blower
7	KODASLIDE 1		X		100W	F.3.7	4 in.	Slide & Spiral	Natural Draft
8	KODASLIDE 2A		X		150W	F.3.5.	5 & 7½ in.	Slide & Spiral	Natural Draft
9	KODASLIDE MASTER		X		300 to 1000W	F.2.3	5 to 11 in.	Slide & Spiral	Heat Ray Filters
10	FILMO SLIDEMASTER		X		500, 750 or 1000W	F.4.5	3½, 5 or 7½ in.	Rack & Pinion	Forced Draft
11	ARGUS		X	X	100W	F.4	4 in.	Sliding	Natural Draft
12	VOKAR		X	X	100W	F.3.5	4 in.	Sliding	Convection
13	GOLDE EG 400-200		X		200W	F.3.5	5 in.	Sliding	Motor Fan
14	KEYSTONE		X		200W	F.4.5	5 in.		Heat Absorbing Unit
15	BEST 202		X		300W	F.3.6	5 in.	Sliding	

STILL PROJECTORS
AND THEIR CHARACTERISTICS

No.	Vertical Pictures	TILT CONTROL	FRAME CENTERING	TYPE OF FEED	SPECIAL FEATURES
1	Yes	Screw		Hand	High screen illumination
2		Front legs		Hand	Double slide carrier, 35mm. strip film attachment
3		Front legs		Hand	Flat table slide carrier
4		Front legs		Hand	Projects up to 200 ft. with arc illuminator
5		Tilting device available		Hand	Combined opaque and slide projector
6		Tilting device available		Hand	Opaque projection only
7	Yes	Knurled knob	Yes	Hand	3 condensing lenses, spherical reflector, takes Kodaslide Readymount changer
8	Yes	Knurled Knob	Yes	Hand	Takes Kodaslide Readymount Changer, switch in base
9	Yes	Knurled Knob	Yes	Hand	Interchangable Condenser Lenses. All Lenses are Coated.
10	Yes	Self locking at both ends	Automatic		Uses new type base-up lamp, 2 heat filters, thermostatic switch, A.C. or D.C.
11	Yes	Yes	Yes		Rotary metal slide carrier
12	Yes	Yes	Yes	Hand	Spherical reflector, slide track carrier
13	Yes	Yes	Yes	Hand	Automatic stacking of slides
14	Yes	Screw			Silvered reflector, 3-piece condenser unit
15		Front legs			Metal slide carrier

STILL PROJECTORS

AND THEIR CHARACTERISTICS

No.	NAME	Accommodates			LAMP WATTAGE	LENS		TYPE OF FOCUS	COOLING UNIT
		3¼x4	2x2	35mm		Speed	Size		
16	AUTO SLIDE 18		X		100W	F.3.7	4 in.	Friction	Natural Draft
17	SPENCER GK	X	X	X	750W		6½ to 24	Helical	Heat Filter & Motor Fan
18	MARTON		X	X	100W	F.3.5		Spiral	Air Cooled Slide Ca rier
19	SELECTROSLIDE		X		300W	F.3.5	5 in.	Spiral	Fan Cooled
20	S.V.E. TRI-PURPOSE CC		X	X	100W		5 in.	Slide	Heat Ray Filters
21	S.V.E TRI-PURPOSE AAA		X	X	300W		5 in.	Helical	Heat Ray Filters
22	S.V.E. MINIATURE DK		X		150W		5 in.	Helical	Heat Ray Filters
23	S.V.E. 3 DIMENSIONAL	2x4¼		X	600W		5 in.	Helical	Heat Ray Filters
24	S.V.E. PICTUROL G			X	300W		4 in.	Slide	Heat Ray Filters
25	LEITZ S 300		X	X	300W			Helical	Natural Draft
26	SKAN		X		100W	F.3.5	5 in.	Slide	Heat Ray Filters
27	AMPRO		X	X	300W	F.3.5		Hair-line	
28	GOLDE NU-MANUMATIC		X		300W			Slide	Heat ray Filters
29	T. D. C.				300W		5 in.	Ratchet	Natural draft
30	ICONOVISOR			X	200W		2 in.	Sliding	Motor fan

STILL PROJECTORS
AND THEIR CHARACTERISTICS

No.	Vertical Pictures	TILT CONTROL	FRAME CENTERING	TY FE C F FEED	SPECIAL FEATURES
16	Yes	Screw		Motor	Cast aluminum housing, switch control
17		Front and rear legs			Extension bellows
18	Yes	Adjuster wheel	Yes	Hand	Triple condenser system
19	Yes		Yes	Automatic	Magazine interchangeable, holds 48 slides
20	Yes	Lever	Yes	Hand	Natural draft ventilation, noiseless, horizontal slide carrier
21	Yes	Lever	Yes	Hand	Natural draft ventilation—semi-automatic vertical slide changer
22	Yes	Lever	Yes	Hand	Natural draft ventilation—semi-automatic vertical slide changer
23	Yes	Lever	Yes	Hand	Film is projected through polaroid filters, and viewed through Polaroid viewers
24		Lever	Yes	Hand	Automatic rewind as film is shown
25	Yes	Screw & lever		Hand	Rotating lens carrier, takes Leica Camera lenses
26	Yes	Yes	Yes	Hand	Holds 32 glass slides
27	Yes	Yes	Yes	Hand	Self Centering
28	Yes	Yes	Yes	Hand	Automatically stacks slides
29	Yes	Screw	Yes	Hand	
30		Yes	Yes	Automatic	For 35mm. safety film, special heat filter

MOTION PICTURE CAMERAS

16 mm.

	CAMERA	SHUTTER OPENING	SPEEDS	EXPOSURE AT 16 FRAMES	LENS AND MOUNTS	FILM CAPACITY
1	CINE KODAK Model K	167.5°	8, 16	1/32 sec.	Single lens, interchangeable Kodak Anastigmat F. 1.9.	100 ft. or 50 ft.
2	CINE KODAK Magazine Model	165°	16, 32, 64	1/32 sec.	Single lens interchangeable Kodak Anastigmat F. 1.9.	50 ft. Magazine.
3	CINE KODAK SPECIAL	165° Adjustable Dissolving Shutter	8, 16, 24 32, 64	1/32 sec.	2 lens, turret interchangeable Kodak Anastigmat F. 1.9 and F. 2.7.	50 ft., 100 ft. and 200 ft.
4	CINE KODAK Model E	165°	16, 32, 64	1/32 sec.	Single screw type mount Kodak Anastigmat F. 1.9. and F. 3.5.	100 ft. or 50 ft.

MOTION PICTURE CAMERAS

16 mm.

	TYPE OF DRIVE	FOOTAGE PER WINDING	TYPE OF FOCUS	TYPE OF FINDER	SPECIAL FEATURES
1	Spring motor.	18 ft.	Lens setting to scale.	Full vision eye level and reflecting view finder.	Footage indicator.
2	Spring motor.	11 ft.	Lens setting to scale.	Full vision eye level.	Footage meter on each magazine.
3	Special spring motor also hand crank	40 ft. spring wind 200 ft. motor operation.	Built-in critical magnifying focuser direct on ground glass.	Full vision eye level and special reflex finder.	Electric motor attachment, frame and footage indicator, exposure guide, eight interchangeable lenses, variety of masks.
4	Spring motor.	20 ft.	Fixed focus.	Eye level finder.	Footage indicator.

MOTION PICTURE CAMERAS

16 mm.

No.	NAME	SHUTTER OPENING	SPEEDS	EXPOSURE	FILM CAPACITY	LENS AND MOUNTS
5	ACME 16 Production Camera	170° Adjustable manually operated for dissolves or control opening	24 Frames with synchronous motor. Other speeds with special motor	1/50 sec. at 24 frames. 1/34 sec. at 16 frames	400 ft. or 1000 ft. in Acme magazines	Single lens mount to take any 16mm. lens in Type C mount
6	ACME Animation & Special Effects Camera	170° Adjustable Dissolving	1/8, 1/3, 3/4, 1-1/2, 2, 3 ft. per min.	Stop Motion 1/4, 1/3, 1/2, 1, 2, 5 sec.	Single or 4-turret C-Mounts	1,000 or 400 ft. magazines.
7	REEVES 16mm. Reflex Camera	170° variable opening can be controlled while camera is in operation	Any speed to 48 frames per second	1/50 sec. at 24 frames. 1/34 sec. at 16 frames	400 ft. in special Reeves Buckleproof magazines	3-lens turret. Any standard lens fitted in oversize mounts. oversize mounts.

MOTION PICTURE CAMERAS

16 mm.

	TYPE OF DRIVE	Footage per Winding	TYPE OF FOCUS	TYPE OF FINDER	SPECIAL FEATURES
5	110 Volt Synchronous motor for Sound Work. Wild Motor for other work	Continuous	Magnifying Image direct. Adjustable Eyepiece. Also Lens Calibrations.	Reflex through Photo lens. No Paralax	Perfect registration for color work. Can be used without Blimp.
6	Automatic Motor for Stop Motion	Continuous	Magnifying direct on ground film plus lens setting to scale	Magnifier direct on film through photographic lens	This camera used for animation printing and special effects. Camera has 2 registration pins on one side only. Can be used on production with 1440 motor.
7	Light weight Synchronous or Wild Motor to 48 Frames. 12-24 or 110 volts, quick detachable. A.C. or D.C.	Continuous	Focusing microscope adjustable magnifier. Picture right side up and correct as to right and left. Also lens callibrations.	Reflecting Finder through photo lens while Camera is in operation. Also Direct vision auxiliary view finder	Body of Camera in same size as 35mm. automatic buckleproof device. Pilot pin registration.

MOTION PICTURE CAMERAS

16 mm.

	NAME	SHUTTER OPENING	SPEEDS	EXPOSURE	FILM CAPACITY	LENS AND MOUNTS
8	MAURER Professional Camera	Fixed opening 240°. Also supplied with adjustable 170°	24 frames sec. with sync. motor. Other speeds with wild motor or spring drive	1/35 sec. at 240° (24 frames) 1/50 sec. at 170° (24 frames). See Page	100-200 ft. daylight load 400-1200 ft. darkroom load	3 lens turret any standard lens. Type "C" mount.
9	MITCHELL 16 Camera	175° manually operated control for various openings	24 frames with sync. motor. Other speeds with wild motor	1/48 sec. at 24. 1/32 sec. at 16. See Page226 For other exposures	400 ft. in Mitchell Magazines	4-lens turret micrometer focus mounts. Bausch & Lomb, Baltar, Astro, or any standard lens.
10	BASS R.C.A. Newsreel Sound on film	180°	16-24	1/34 sec.	100 ft. 400 ft. External Magazines may be installed	Any Standard Lens 3 Lens Revolving Turret

MOTION PICTURE CAMERAS

16 mm.

	TYPE OF DRIVE	Footage per Winding	TYPE OF FOCUS	TYPE OF FINDER	SPECIAL FEATURES
8	110-volt single phase synchronous 220 volt, 3-phase synchronous 12-volt D.C. governor-controlled. 110-volt Universal wild motor with tachometer. Spring drive—detachable. Single-frame animation motor	Continuous with motors. 36 feet with spring drive	Camera rack over microscope on clear glass reticle, full aperture for composition with projector aperture marked. Critical focus at high magnification by coincidence with cross lines on reticle.	Erecting prism. Automatic paralax correction	Gear-driven magazines of 200-foot, 400-foot, 1200-foot capacity. Frame and footage counter. 8-frame hand crank.
9	110-volt sync. 9 motor or wild motor with adjustable speed control	Continuous	Camera shift over erect image focusing telescope, adjustable eye piece. Also lens calibrations	Large erect image prism view finder with mattes for various size lenses.	Can be used with or without Blimp for sound work. Contains features of standard Mitchell Cameras.
10	Operated by 3 Flashlight Batteries	40 ft. at 16 frames 24 ft. at 24 frames	Lens scale and Critical Focuser	Spy Glass, Parallax Adjustment	Studio recording galvanometer, also electric motor for battery or amplifiers. Mouthpiece recording microphone

MOTION PICTURE CAMERAS

16 mm.

No.	NAME	SHUTTER OPENING	SPEEDS	EXPOSURE at 16 Frames	FILM CAPACITY	LENS AND MOUNTS	FOOTAGE PER WINDING
11	FILMO AUTO-LOAD	135°	16-24-32-48-64	1/43 sec.	50 ft. Magazine	F.2.5 1 in. Screw Mount Filmo-coted	12½ ft.
12	FILMO AUTO-MASTER	135°	16-24-32 48-64	1/43 sec.	50 ft. Magazine	F.2.5—1 in. Filmocoted Universal Focus 3 Lens Turrent	12½ ft.
13	FILMO 70—DA	204°	8-12-16-24 32-48-64	1/27 sec.	50 or 100 ft. B & W or Color	F.1.9 Screw Mount—Filmocoted 3 Lens Turret	23 ft.
14	FILMO 70—DE	204°	8-12-16-24 32-48-64	1/27 sec.	50 or 100 ft. B & W or Color	F.1.9 1 in. Screw Mount Filmocoted	23 ft. with Spring Motor
15	FILMO 70-DE SPECIALIST	204°	8-12-16-24 32-48-64	1/27 sec.	50 or 100 ft. B & W or Color	F.1.9 1 in. Screw Mount Filmocoted	23 ft. with Spring Motor
16	FILMO 70-H	204°	8-12-16-24 32-48-64	1/27 sec.	50 or 100 ft. B & W or Color	F.1.9 1 in. Screw Mount Filmocoted	23 ft. with Spring Motor
17	FILMO 70-H SPECIALIST	204°	8-12-16-24 32-48-64	1/27 sec.	50 or 100 ft. B & W or Color	F.1.9 1 in. Screw Mount Filmocoted	23 ft. with Spring Motor

MOTION PICTURE CAMERAS
16 mm.

No.	TYPE OF DRIVE	TYPE OF FOCUS	TYPE OF FINDER	SPECIAL FEATURES
11	Spring Motor Gear Drive	Universal Focus Direct Focuser Available	Positive Type Interchangeable	Built-in Lens Shade on all lenses—Built-in Exposure Calculator—Single Frame Release—Starting Button Lock—Direct Focuser through lens (optional).
12	Spring Motor Gear Drive	Universal Focus Direct Focuser Available	Positive Type Interchangeable	Three Lens Turret accommodates all B & H lenses and matching viewfinder objectives. Single Frame exposure device—starting button lock—built-in Exposure Calculator.
13	Spring Motor Gear Drive	Direct through Lens	Spy Glass Type Variable Area Revolving Drum	Slack Film Take-up—shock absorbing Sprockets—starting button will not operate unless lens is in position—Three Lens Turret.
14	Spring Motor or Hand Crank	Direct through the Lens	Positive Type	Three Lens Turret—Spring Motor automatically maintains speed through run—positive-type Viewfinder Turret—Hand Crank and Rewind Knob.
15	Spring Motor or Hand Crank	Professional Type Shift-over Focuser	Positive Type	Four Lens Turret—Positive Viewfinder Turret—Shift-over Focus—Parallax Eliminator—Hand Crank and Rewind Knob.
16	Spring Motor, Hand Crank or Electric Motor	Direct through the Lens	Positive Type	Three Lens Turret—Positive Viewfinder Turret—Shutter Stabilizer—Veeder Footage Counter—Adapted for Electric Motor External Film Magazines. Motor or Magazines not included.
17	Spring Motor, Hand Crank or Electric Motor	Professional Type Shift-over Focuser	Positive Type	Four Lens Turret—Positive Viewfinder Turret—Shutter Stabilizer—Shift-over Focus—Adapted for Motor External Film Magazines. Hand Crank and Rewind Knob.

MOTION PICTURE CAMERAS
16 mm.

No.	NAME	SHUTTER OPENING	SPEEDS	EXPOSURE at 16 Frames	FILM CAPACITY	LENS AND MOUNTS	FOOTAGE PER WINDING
18	CINKLOX 35		3 Speeds			Woolensak F.2.5 Coated	
19	DE VRY	160°	16-24-64	1/36 sec.	100 ft. Daylight Load	F.2.5 Coated Type C Mount	22 ft.
20	DE VRY V.A. Sound	160°	24	1/50 sec. at 24 Frames	400 ft.	F.1.5-25 mm. Micrometer Mount	Continuous
21	KEYSTONE A3	160°	12-16-64	1/36 sec.	100 ft.	F.3.5 1 in. Fixed Focus	18 ft.
22	KEYSTONE B1	160°	16	1/36 sec.	100 ft.	F.3.5 1 in. Fixed Focus	18 ft.
23	LEKTRO 2 Models		8-32 16-24		Magazine	B & L F.3.5 C Mounts	Continuous
24	VICTOR 3	205°	8-16-24 32-64	1/28 sec.	100 ft.	1 in. F.2.5 Fixed Focus Coated	22 ft.
25	VICTOR 4	205°	8-16-24 32-64	1/28 sec.	100 ft.	3 Lens Turret Takes Any S.M. P.E. Cine Lens	22 ft.
26	VICTOR 5	205°	8-16-24 32-64	1/28 sec.	100 ft.	3 Lens Turret Takes Any S. M. Cine Lens	22 ft.

MOTION PICTURE CAMERAS

16 mm.

No.	TYPE OF DRIVE	TYPE OF FOCUS	TYPE OF FINDER	SPECIAL FEATURES
18	Spring	Range Finder	Direct	Visual Footage Indicator—Lock-on Starting Button.
19	Duplex Spring	Fixed Focus	Direct Eye Level	Built-in Exposure Chart—square shape rests steady anywhere—Interchangeable Lenses.
20	Synchronous 110 Volt AC or 12 Volt DC	Direct on Film through Prism	Precision Telescopic Parallax Adjustment	Complete recording system—Galvanometer and Fittings—Full Range Recording Amplier—Tone Compensator.
21	Spring Motor	Fixed Focus and Focusing Mount	Spy Glass Type	Lenses interchangeable—Carrying Handle—Tripod Connection.
22	Spring Motor	Fixed Focus and Focusing Mount	Spy Glass Type	Slack film take-up—Built-in lens shade and Exposure Guide.
23	BATTERY		OPTICAL	ELECTRIC DRIVE—TAKES EASTMAN MAGAZINES.
24	Hand Crank and Dual Spring Motor	Interchangeable Lens Mount	Adjustable Dist-A-Sight View Finder with 4 Lens Field Areas	Self-setting Film Footage Scale—Sealed Power Unit—Stop Gears—Built-in Exposure Meter—Takes any S.M.P.E. Cine Lens.
22	Hand Crank and Twin Spring Motor	Full Vision Focuser through Lens	Adjustable Dist-A-Sight View Finder with 4 Lens Field Areas	Sealed Power Unit—Gear Driven Footage Meter—Three Lens Rotating Turret.
26	Hand Crank and Twin Spring Motor	Full Vision Focuser through Lens	Adjustable Dist-A-Sight View Finder with 4 Lens Field Areas	Sealed Power Unit—Gear Driven Footage Meter—Crank Back for laps and dissolves—Three Lens Rotating Turret

SHUTTER EXPOSURE
FOR 16 mm. CAMERAS
Exposure Time Obtained with Various Camera Speeds and Shutter Openings

Shutter Opening	CAMERA SPEEDS: 8 Pictures per Second	12 Pictures per Second	16 Pictures per Second	24 Pictures per Second	32 Pictures per Second	48 Pictures per Second	64 Pictures per Second
	EXPOSURE IN PARTS OF A SECOND						
220°	1/12	1/20	1/24	1/40	1/48	1/80	1/96
210°	1/13	1/21	1/26	1/42	1/54	1/84	1/108
200°	1/14	1/22	1/28	1/44	1/56	1/88	1/112
190°	1/15	1/23	1/30	1/46	1/60	1/92	1/120
180°	1/16	1/24	1/32	1/48	1/64	1/96	1/128
170°	1/17	1/25	1/34	1/50	1/68	1/100	1/136
160°	1/18	1/27	1/36	1/54	1/72	1/108	1/144
150°	1/19	1/28	1/38	1/56	1/76	1/112	1/152
140	1/20	1/30	1/40	1/60	1/80	1/120	1/160
130°	1/22	1/33	1/44	1/66	1/88	1/132	1/176
120°	1/24	1/36	1/48	1/72	1/96	1/144	1/192
110°	1/26	1/40	1/52	1/80	1/104	1/160	1/208
100°	1/28	1/44	1/58	1/88	1/116	1/176	1/232
90°	1/32	1/48	1/64	1/96	1/128	1/192	1/256
80°	1/36	1/54	1/72	1/108	1/144	1/216	1/288
70°	1/40	1/60	1/80	1/120	1/160	1/240	1/320
60°	1/48	1/72	1/96	1/144	1/192	1/288	1/384

LENS DIAPHRAGM OPENING CONSTANT

FRAME EQUALIZER

Showing Comparison of Frames in Various Footage Totals

Feet of Film	35mm. Film Frames	16mm. Film Frames	8 mm. Film Frames	Feet of Film	35mm. Film Frames	16mm. Film Frames	8 mm. Film Frames
¼ =	4 =	10 =	20	11 =	176 =	440 =	880
½ =	8 =	20 =	40	12 =	192 =	480 =	960
¾ =	12 =	30 =	60	13 =	208 =	520 =	1040
1 =	16 =	40 =	80	14 =	224 =	560 =	1120
1¼ =	20 =	50 =	100	15 =	240 =	600 =	1200
1½ =	24 =	60 =	120	16 =	256 =	640 =	1280
1¾ =	28 =	70 =	140	17 =	272 =	680 =	1360
2 =	32 =	80 =	160	18 =	288 =	720 =	1440
2¼ =	36 =	90 =	180	19 =	304 =	760 =	1520
2½ =	40 =	100 =	200	20 =	320 =	800 =	1600
2¾ =	44 =	110 =	220	22 =	352 =	880 =	1760
3 =	48 =	120 =	240	24 =	384 =	960 =	1920
3¼ =	52 =	130 =	260	26 =	416 =	1040 =	2080
3½ =	56 =	140 =	280	28 =	448 =	1120 =	2240
3¾ =	60 =	150 =	300	30 =	480 =	1200 =	2400
4 =	64 =	160 =	320	32 =	512 =	1280 =	2560
4¼ =	68 =	170 =	340	34 =	544 =	1360 =	2720
4½ =	72 =	180 =	360	36 =	576 =	1440 =	2880
4¾ =	76 =	190 =	380	38 =	608 =	1520 =	3040
5 =	80 =	200 =	400	40 =	640 =	1600 =	3200
6 =	96 =	240 =	480	42 =	672 =	1680 =	3360
7 =	112 =	280 =	560	44 =	704 =	1760 =	3520
8 =	128 =	320 =	640	46 =	736 =	1840 =	3680
9 =	144 =	360 =	720	48 =	768 =	1920 =	3840
10 =	160 =	400 =	800	50 =	800 =	2000 =	4000

CAMERA IDENTIFICATION MARKS

For 16 mm. and 8 mm. Cameras

CAMERA IDENTIFYING MARKS SHOWN ON EDGE OF FILM BY VARIOUS CAMERAS

A small identifying mark of special design is cut into the side of the camera aperture gate of most standard 16 mm. and 8 mm. cameras in such a manner that shows up along the edge of each frame when an exposure is made and the film is developed, making it possible to tell at a glance in what camera the film has been shot thru.

These marks appear only when the film has been exposed thru the camera and processed, either to a negative or reversal positive.

They do not appear on the duplicate prints, nor do they show upon the screen when the film is projected, as the projector aperture is slightly smaller than the camera aperture (See Camera and Projector Standards, pages 181 and 246), thus masking off that part of the film from the screen.

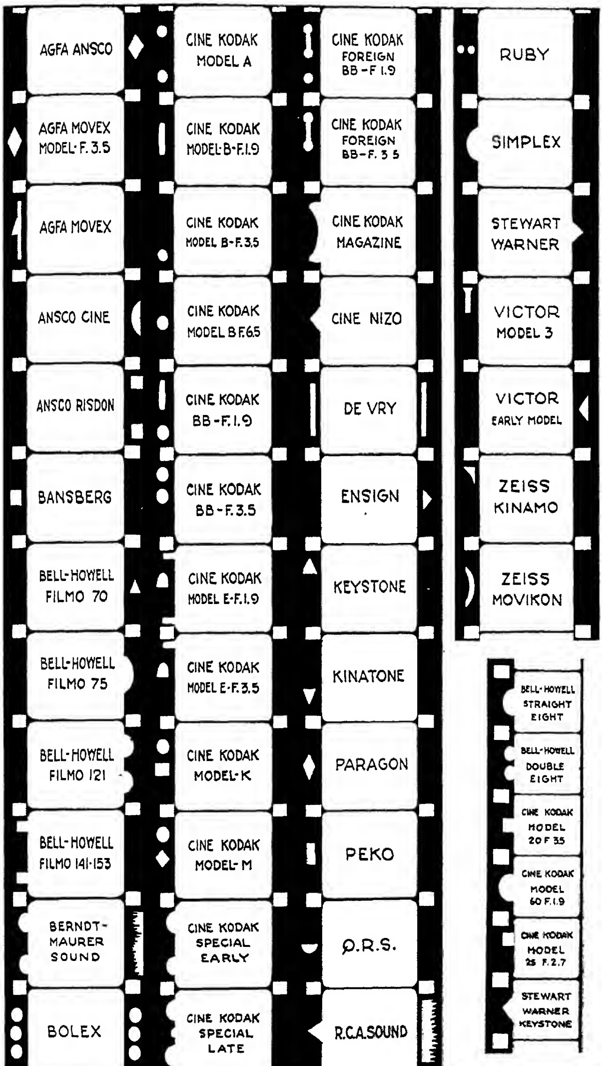
They should be viewed from the celluloid side with the picture erect.

The Mitchell 16 has no identification marks.

The Acme 16 has no identification marks.

The Reeves Reflex 16 has two round dots on the right side of the frame.

The Maurer Professional 16 has the letter "M" on one side of the frame.


AGFA ANSCO
AGFA MOVEX MODEL F. 3.5
AGFA MOVEX
ANSCO CINE
ANSCO RISDON
BANSBERG
BELL-HOWELL FILMO 70
BELL-HOWELL FILMO 75
BELL-HOWELL FILMO 121
BELL-HOWELL FILMO 141-153
BERNDT-MAURER SOUND
BOLEX
CINE KODAK MODEL A
CINE KODAK MODEL B-F.1.9
CINE KODAK MODEL B-F.3.5
CINE KODAK MODEL B F.6.5
CINE KODAK BB-F.1.9
CINE KODAK BB-F.3.5
CINE KODAK MODEL E-F.1.9
CINE KODAK MODEL E-F.3.5
CINE KODAK MODEL-K
CINE KODAK MODEL-M
CINE KODAK SPECIAL EARLY
CINE KODAK SPECIAL LATE
CINE KODAK FOREIGN BB-F 1.9
CINE KODAK FOREIGN BB-F. 3.5
CINE KODAK MAGAZINE
CINE NIZO
DE VRY
ENSIGN
KEYSTONE
KINATONE
PARAGON
PEKO
Q.R.S.
R.C.A. SOUND
RUBY
SIMPLEX
STEWART WARNER
VICTOR MODEL 3
VICTOR EARLY MODEL
ZEISS KINAMO
ZEISS MOVIKON
BELL-HOWELL STRAIGHT EIGHT
BELL-HOWELL DOUBLE EIGHT
CINE KODAK MODEL 20 F 3.5
CINE KODAK MODEL 60 F.1.9
CINE KODAK MODEL 25 F.2.7
STEWART WARNER KEYSTONE

ANSCO MOTION PICTURE FILMS

16mm. CAMERAS

NAME	TYPE	USE	CHARACTERISTICS	ROLLS AVAILABLE	SPEED: WESTON Day	SPEED: WESTON Tung	SPEED: G. E. Day	SPEED: G. E. Tung
TRIPLE S PAN REVERSIBLE	Rev.	Interiors, Sports Difficult light conditons	Extreme high speed, balanced color sensitivity, fine grain, wide latitude, medium contrast	100 ft. DLL 200 ft. DLL 400 ft. DRL	100	64	150	100
HYPAN REVERSIBLE	Rev.	General outdoor work, sports and portraits flat light conditions	High speed, ful color balance brilliance and fine grain, excellent for filter use	100 ft. DLL 200 ft. DLL 400 ft. DRL	32	24	48	40
SUPREME NEGATIVE	Neg.	All classes of Interior and exterior work commercial pictures	Extreme high speed, unusually fine grain, full color sensitivity, anti-halation base	100 ft. DLL 200 ft. DLL 400 ft. DRL	64	40	100	64
HIGH-RESOLVING SOUND RECORDING FILM		Variable area sound recording	Fine grain, high resolving power	200 ft. DLL 400 ft. DRL 800 ft. DRL 1200 ft. DRL				
DUPLICATING NEGATIVE	Dup	For making "Dupe" negatives by contact or reduction	Slow speed, fine gran	400 ft. DRL 1200 ft. DRL				

ANSCO MOTION PICTURE FILMS

16mm. CAMERAS

NAME	TYPE	USE	CHARACTERISTICS	ROLLS AVAILABLE	SPEED WESTON Day	SPEED WESTON Tung	SPEED G. E. Day	SPEED G. E. Tung
ANSCO COLOR FILM TYPE 234	Rev.	General color photography where a single original suitable for projection is needed	Balanced for exposure by 3200 K illumination	100 ft. DLL 200 ft. DLL 400 ft. DRL 800 ft. DRL 1200 ft. DRL		12		18
TYPE 235	Rev.	General color photography where a single original suitable for projection is needed	Balanced for exposure by bright sunlight	100 ft. DLL 200 ft. DLL 400 ft. DRL 800 ft. DRL 1200 ft. DRL	8		12	
COLORPAK CAMERA FILM, TYPE 835	Rev.	Original taking film for general color photography when release prints are needed	Balanced for exposure by daylight or carbon arcs wth Y1 filters. Sultabe as an original for printing but not for projection	100 ft. DLL 200 ft. DLL 400 ft. DRL 800 ft. DRL 1200 ft. DRL	10		16	
COLORPAK RELEASE PRINT FILM TYPE 832	Rev.	Color release prints from Colorpak Type 835	Integral tripack color printing medium yields a positive from a positive	400 ft. DRL 800 ft. DRL 1200 ft. DRL				
COLORPAK DUPLICATING FILM TYPE 232	Reversal	Master dupes from Colorpak Type 835	Integral tripack color printing medium yields a positive from a positive	400 ft. DRL 800 ft. DRL 1200 ft. DRL				

DUPONT MOTION PICTURE FILMS
16mm AND 8mm

NAME	TYPE	USE	CHARACTERISTICS	ROLLS AVAILABLE	WESTON		G. E.	
					Sun	Tung	Sun	Tung
SAFETY NEGATIVE PANCHROMATIC *	301	All purpose, interior and exterior	Fine grain and speed, wide latitude.	100, 400 800 1000 and 1200 ft.	50	32	80	48
SAFETY NEGATIVE PANCHROMATIC *	314	Medium speed, general purpose	Wide latitude perfs. on one or both sides.	100, 400, 800 1000 and 1200 ft.	32	20	48	30
FINE GRAIN PAN-CHROMATIC DUPE	+ 308	For dupe work.	Fine grain duplicating negative, safety base.	800, 1200, and 2000 ft.				
REGULAR SAFETY RELEASE POSITIVE	+ 600	For general release work.	Same emulsion as Type 213, on safety base.	400, 1000, 1200 and 2000 ft.		2		3
FINE GRAIN SAFETY RELEASE POSITIVE	+ 605	For general release work	Same emulsion as type 225, on safety base	400, 1000, 2000 and 2000 ft.				
LEADER STOCK	A 11-A	Developing machines.	.005 inch clear safety leader.					
LEADER STOCK	A 12-A	Developing machines. machines.	.008 inch clear safety leader.					
LEADER STOCK	A 14-A	Developing machines.	.008 inch blue safety leader.					
LEADER STOCK	A-71	For protective use on reel ends.	.005 inch coated safety, non-photographic.					

*Can also be had in 8mm. +Can also be had in 32mm.

EASTMAN MOTION PICTURE FILMS

16mm SAFETY

NAME	TYPE	USE	CHARACTERISTICS	ROLLS AVAILABLE	SPEED WESTON Day	SPEED WESTON Tung	SPEED G. E. Day	SPEED G. E. Tung
CINE-KODAK SUPER X PAN * I	Reversal	All classes of general photography.	Fast speed, medium grain; panchromatic	50, 100, 200 ft. magazines.	32	24	48	40
CINE-KODAK SUPER XX PAN *	Reversal	Interiors, sports. Bad light conditions.	High speed medium grain; panchromatic.	50, 100, 200 ft. magazines.	80	64	125	100
KODACHROME DAYLIGHT *I	Reversal	For use in general Exterior photography.	Color balanced for sunlight.	50, 100, 200 ft. 50 ft. magazines.	8	3	12	5
KODACHROME A *I	Reversal	For use in general interior photography.	Color balanced for photoflood lamps.	50, 100, 200 ft. 50 ft. magazines.	8	12	12	18
KODAK PANCHRO NEGATIVE oI	5240	For all classes of general photography.	Medium speed, fine grain, similar to 35mm Background x	100, 200, 400 ft. Darkroom loading.	24	16	40	24
KODAK SUPER XX NEGATIVE o	5242	For use under very adverse light conditions.	Extreme speed, medium grain. Similar to 35mm Super XX.	100, 200, 400 ft. darkroom loading.	100	64	150	100
KODAK POSITIVE o I	5301	Release prints.	Low speed, clear base.	200, 400, 800, 1200 ft.				
KODAK FINE GRAIN RELEASE POSITIVE o I	5302	Release prints.	Fine grain, high resolving power, excellent definition.	200, 400, 800, 1200 ft.				

*—Purchase price includes free processing by Eastman Kodak Co.
I—Also available perforated one side only.
o—Not processed by Eastman Kodak Co.

EASTMAN MOTION PICTURE FILMS 16mm SAFETY

NAME	TYPE	USE	CHARACTERISTICS	DEVELOPER KODAK No.	REMARKS
HI-CONTRAST POSITIVE	5363	Process, matte and title work.	Slow speed, high contrast.	D16	Suitable for titles, cartoons, and traveling mattes.
SOUND RECORDING	5372	For variable area recording.	Fine grain, low image distortion.	D16	Blue sensitive only; perforated for sound.
SOUND RECORDING	5373	For variable density recording.	Fine grain improved recording.	D76	Blue sensitive only; perforated for sound.
DUPLICATING POSITIVE	5365	Duplicate printing	Low speed, yellow dyed. High resolving power.	D76	Very fine grain, for making duplicate positives.
DUPLICATE NEGATIVE	5203	Original duplicates, and master printing.	Extremely fine grain, Panchromatic sensitivity.	D76	Produces duplicate negatives equal to original quality.
SOUND RECORDING	5357	For variable area and variable density recording.	Medium speed, ultraviolet or white light exposure, perforated on one side.	D16	Maximum emulsion speed for general recording.
SOUND RECORDING	5302	For variable area recording, using white light.	Fine grain positive stock, perforated on one side.	D16	Slow speed, high resolving power. Great image sharpness.
SAFETY LEADER	No. 3	Developing and projection machines.	Non-inflammable, uncoated transparent stock.	100 to 1000 ft. rolls	Available on special order. approximately .0055 in. thick.
SAFETY LEADER	No. 6	Developing and projection machines.	Blue stock, standard 16mm perforations.	100 to 800 ft. rolls.	Approximately .0075 in. thick.
SAFETY LEADER	No. 6	Developing machines.	Black-and-white opaque. Perforated or unperforated.	400 and 1000 ft. rolls	Approximately .0075 in. thick.

LENS ANGLES

Field of View Obtained
At Various Distances from Camera
16 mm. CAMERAS

LENS SIZE

Distance from Lens to Subject	2 INCH		3 INCH		4 INCH		6 INCH	
	Height	Width	Height	Width	Height	Width	Height	Width
Feet	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In
3	4	6						
4	6	8	2	3	2½	3½		
5	8	11	3	5	3	4½		
6	10	1 1	5	7	4	5½	2½	3½
7	1 0	1 4	6	8	4½	6½	3	4
8	1 1	1 6	7	11	5½	7	3½	4½
10	1 5	1 10	9	1 3	7	9	4½	6
12	1 8	2 3	1 1	1 6	8	1 1	5½	7
14	2 0	2 8	1 4	1 8	1 0	1 3	6½	8½
16	2 3	3 1	1 6	2 0	1 2	1 5	7½	10
18	2 7	3 4	1 7	2 3	1 3	1 7	8	1 1
20	2 10	3 9	1 10	2 7	1 5	1 9	9	1 2
25	3 6	4 9	2 4	3 2	1 8	2 4	1 2	1 6
30	4 4	5 8	2 10	3 8	2 2	2 8	1 4	1 9
35	5 2	6 8	3 4	4 5	2 5	3 2	1 7	2 1
40	5 9	7 10	3 9	5 3	2 8	3 8	1 10	2 5
45	6 7	8 8	4 6	5 10	3 0	4 2	2 1	2 9
50	7 1	9 6	4 10	6 6	3 5	4 8	2 4	3 1
60	8 10	11 9	5 8	7 8	4 3	5 7	2 8	3 9
80	11 8	15 6	7 10	10 6	5 7	7 6	3 9	5 1
100	14 5	19 4	9 8	12 10	7 2	9 6	4 8	6 4

Based on Projection Aperture .284x.380.

LENS ANGLES BY DEGREES

ANGLES OBTAINED BY LENSES
OF VARIOUS FOCAL LENGTHS

16 MM. CAMERAS

LENS SIZE		ANGLE of DEGREES	
Inches	mm.	Vertical	Horizontal
5/8	15	27.6	36.6
3/4	20	20.5	27.1
1	25	16.9	21.2
1 3/8	35	11.1	15.7
2	50	8.1	11.4
3	75	5.2	7.2
4	100	4.5	5.3
6	150	2.4	3.4

8 MM. CAMERAS

1/2	12 1/2	14.8	19.7
1	25	7.4	9.9
1 1/2	38	5.0	6.6

CAMERA SET-UPS

Camera Distance for Normal Size Figures with Various Lenses

16 mm. CAMERAS

	Large Head		Head, shoul-		Waist figure		Thigh figure		Knee figure		Short figure		Tall figure	
	SIZE OF IMAGE													
Lens Size in MM.	12 in.		16 in.		24 in.		36 in.		48 in.		60 in.		72 in.	
	DISTANCE FROM LENS TO SUBJECT													
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
15	2	1	3	0	4	2	6	3	8	4	10	2	12	5
20	2	8	4	0	5	6	8	3	11		13	8	16	7
25	3	5	5	1	7	0	10	6	14		17	5	21	
35	4	9	7	1	9	7	14	6	19	6	24	6	29	6
50	7	0	10	3	14	0	21	2	28		35		42	6
75	11	0	15	8	21	0	30		42		54		64	
100	14	0	20	9	28	0	40		55		70		88	
125	17	6	25	6	36	0	52		70		89		109	
150	21	0	31	6	42	0	64		85		108		130	

8 mm. CAMERAS

	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
12½	3	5	5	1	7	0	10	6	14		17	5	21	
25	7	0	10	3	14	0	21	2	28		35		42	6
38	11	0	15	8	21		30		42		54		64	

HYPERFOCAL DISTANCES

FOR 8 mm. AND 16 mm. CAMERA LENSES

LENS SIZE

Lens Value	12½ mm.	15 mm.	20 mm.	1 inch	1½ inch
	HYPERFOCAL DISTANCE IN FEET				
F. 1.4	14½	20¾	36¾	59½	134
1.5	13½	19	34½	55½	125
1.8	11¼	16	28¾	46¼	104
2.	10	14½	25¾	41¾	93
2.5	8	11¼	20¾	33½	75
3.	6¾	9¾	17	27¾	62½
3.5	5¾	8	19	23¾	53½
4.	5	7	16½	20¾	46¾
4.5	4½	6¼	14¾	18½	41¾
5.	4	5½	13¼	16¾	37½
5.6	3½	5	9¼	14¾	33½
6.3	3¼	4½	8¼	13½	29¾
8.	2½	3½	6½	10¾	23½
9.1	2	3¼	6¼	9¼	20½
11.	1¾	2½	6	7½	17
12.5		2¼	5	6¾	15
16.		1¾	4	5¼	11¾

Distance at and beyond which all objects are in focus when sharp focus is secured at infinity. However when a lens is focused on the hyperfocal distance, then everything from one half the hyperfocal to infinity will be sharply defined.

DEPTH OF FOCUS*

1½ inch LENS—16mm CAMERAS

Point of Focus	F.2	F.2.8	F.4	F.5.6	F.8	F.11
	IN FOCUS FROM					
Feet	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.	Ft. In. Ft. In.
3	2 10 to 3 2	2 9 to 3 2	2 8 to 3 4	2 7 to 3 7	2 6 to 3 9	2 4 to 4 2
4	3 9 to 4 4	3 8 to 4 4	3 7 to 4 7	3 4 to 5 2	3 4 to 5 6	3 2 to 5 10
5	4 8 to 5 5	4 7 to 5 8	4 4 to 6 0	4 1 to 6 8	3 10 to 7 10	3 6 to 8 0
6	5 6 to 6 8	5 4 to 6 10	5 0 to 7 6	4 10 to 8 7	4 6 to 10 2	4 0 to 12 6
7	6 4 to 7 8	6 2 to 8 3	5 10 to 9 3	5 3 to 10 2	5 0 to 15 5	4 6 to 20 8
8	7 3 to 9 3	6 11 to 9 9	6 7 to 11 7	6 0 to 13 3	5 7 to 24 8	5 0 to 36 0
9	7 11 to 10 6	7 9 to 10 7	7 2 to 13 2	6 8 to 17 6	6 2 to 51 0	5 5 to 82 4
10	8 8 to 12 0	8 4 to 12 2	7 8 to 15 2	7 4 to 24 0	6 6 to 58 6	6 0 to 120 0
12	10 5 to 15 0	9 10 to 17 0	9 3 to 22 4	8 6 to 30 5	7 4 to 70 0	6 8 to Inf.
14	12 0 to 18 9	10 8 to 20 4	10 1 to 26 8	9 2 to 40 8	7 10 to 110 0	7 2 to Inf.
16	13 1 to 22 6	12 2 to 26 8	11 2 to 30 2	10 0 to 58 2	8 8 to Inf.	7 9 to Inf.
18	14 4 to 26 2	13 6 to 33 3	12 0 to 40 0	10 10 to Inf.	9 3 to Inf.	8 0 to Inf.
20	15 8 to 31 0	14 7 to 44 0	13 3 to 62 6	11 8 to Inf.	10 0 to Inf.	9 2 to Inf.
25	18 3 to 47 2	17 0 to 91 6	15 2 to Inf.	13 6 to Inf.	11 4 to Inf.	9 10 to Inf.
30	20 9 to 53 8	19 4 to 126 4	17 4 to Inf.	14 10 to Inf.	12 2 to Inf.	10 5 to Inf.
35	23 0 to 60 4	21 8 to 340 8	18 3 to Inf.	16 2 to Inf.	13 0 to Inf.	11 6 to Inf.
40	26 9 to 110 8	24 4 to Inf.	20 8 to Inf.	17 4 to Inf.	13 10 to Inf.	12 0 to Inf.
45	28 7 to 132 6	25 9 to Inf.	22 4 to Inf.	18 6 to Inf.	14 8 to Inf.	12 6 to Inf.
50	30 6 to 154 0	27 6 to Inf.	24 6 to Inf.	19 8 to Inf.	15 6 to Inf.	13 3 to Inf.
75	45 8 to Inf.	40 2 to Inf.	32 0 to Inf.	26 4 to Inf.	20 0 to Inf.	18 8 to Inf.

*Depth of Field

Calculated at 1/1000 inch Circle of Confusion

DEPTH OF FOCUS

2 INCH LENS—16 mm. CAMERAS

IN FOCUS FROM

Point of Focus	F.2				F.2.8				F.4				F.5.6				F.8				F.11			
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	'In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In
3	2	11 to	3	1	2	11 to	3	0	2	11 to	3	2	2	7 to	3	2	2	10 to	3	3	2	9 to	3	4
4	3	10 to	4	2	3	10 to	4	2	3	10 to	4	2	3	9 to	4	4	3	8 to	4	5	3	6 to	4	4
5	4	9 to	5	3	4	10 to	5	3	4	9 to	5	4	4	7 to	5	5	4	6 to	5	8	4	4 to	6	0
6	5	10 to	6	3	5	9 to	6	4	5	7 to	6	6	5	6 to	6	8	5	3 to	7	0	5	0 to	7	6
7	6	9 to	7	4	6	7 to	7	6	6	6 to	7	8	6	3 to	7	11	6	0 to	8	5	5	8 to	9	2
8	7	8 to	8	5	7	6 to	8	7	7	4 to	'8	10	7	0 to	9	3	6	9 to	9	11	6	4 to	10	11
9	8	6 to	9	6	8	5 to	9	9	8	2 to	10	0	7	10 to	10	7	7	5 to	11	5	6	11 to	12	10
10	9	5 to	10	7	9	3 to	10	11	8	11 to	11	4	8	7 to	12	0	8	0 to	13	1	7	6 to	15	0
12	11	2 to	12	11	10	11 to	13	4	10	6 to	14	0	10	0 to	15	0	9	4 to	16	10	8	7 to	20	0
15	13	9 to	16	6	13	4 to	17	2	12	9 to	18	4	12	0 to	20	0	11	0 to	23	4	10	0 to	30	0
18	16	2 to	20	1	15	8 to	21	3	14	9 to	23	0	13	9 to	25	9	12	11 to	32	4	11	6 to	45	0
20	17	10 to	22	8	17	2 to	24	0	16	0 to	26	0	15	0 to	30	0	13	6 to	38	3	12	0 to	60	0
25	21	0 to	29	5	20	8 to	31	8	19	2 to	35	9	17	8 to	43	0	15	9 to	61	11	13	9 to	150	0
30	25	0 to	36	6	23	11 to	40	0	22	0 to	47	0	20	0 to	60	0	17	6 to	105	0	15	0 to	Inf.	
35	29	0 to	44	5	27	0 to	49	6	24	7 to	60	6	22	1 to	84	0	19	3 to	210	0	16	2 to	Inf.	
40	32	5 to	52	6	29	11 to	60	3	27	0 to	77	3	24	0 to	120	0	20	0 to	840	0	17	2 to	Inf.	
50	38	7 to	71	6	35	3 to	86	6	31	2 to	126	0	27	8 to	300	0	22	0 to	Inf.		18	9 to	Inf.	
75	51	9 to	136	6	46	0 to	200	3	39	1 to	77	9	33	5 to	Inf.		26	11 to	Inf.		21	4 to	Inf.	
100	62	9 to	250	0	54	6 to	625	..	45	3 to	Inf.		37	6 to	Inf.		29	6 to	Inf.		23	0 to	Inf.	

Calculated at 1/1000 inch Circle of Confusion.

DEPTH OF FOCUS *

3 inch LENS—16mm CAMERAS

Point of Focus	F.2				F.2.8				F.4				F.5.6				F.8				F.11			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	2	10 to	3	2	2	9 to	3	2	2	11 to	3	2	2	10 to	3	2	2	9 to	3	3	2	8 to	3	4
4	3	11 to	4	1	3	11 to	4	1	3	10 to	4	1	3	9 to	4	2	3	9 to	4	3	3	9 to	4	3
5	4	11 to	5	2	4	11 to	5	2	4	11 to	5	2	4	10 to	5	3	4	3 to	5	3	4	8 to	5	5
6	5	11 to	6	2	5	10 to	6	2	5	10 to	6	3	5	9 to	6	3	5	8 to	6	5	5	6 to	6	6
7	6	10 to	7	2	6	10 to	7	3	6	9 to	7	3	6	8 to	7	5	6	6 to	7	7	6	4 to	7	10
8	7	9 to	8	3	7	9 to	8	3	7	8 to	8	4	7	6 to	8	6	7	4 to	8	9	7	2 to	9	7
9	8	10 to	9	3	8	9 to	9	4	8	7 to	9	5	8	2 to	9	8	8	2 to	9	11	7	11 to	10	4
10	9	9 to	10	3	9	8 to	10	5	9	6 to	10	6	9	5 to	10	10	9	0 to	11	2	8	3 to	11	3
12	11	8 to	12	5	11	6 to	12	7	11	3 to	12	10	11	0 to	13	2	10	8 to	13	9	10	6 to	14	6
14	13	6 to	14	6	13	4 to	14	9	13	0 to	15	2	12	2 to	15	8	12	2 to	16	6	11	7 to	17	7
16	15	4 to	16	9	15	1 to	17	0	14	9 to	17	6	14	4 to	18	2	13	8 to	19	3	13	0 to	21	0
18	17	3 to	18	11	16	10 to	19	4	16	6 to	19	11	15	10 to	20	9	15	0 to	22	4	14	3 to	24	6
20	19	0 to	21	1	18	7 to	21	7	18	0 to	22	5	17	5 to	23	6	16	6 to	25	5	15	6 to	28	5
25	23	5 to	26	11	22	10 to	27	6	22	0 to	28	11	21	0 to	30	9	19	9 to	34	0	18	4 to	39	6
30	27	10 to	32	7	27	0 to	33	10	25	10 to	35	9	24	6 to	38	9	22	9 to	44	2	20	5 to	53	9
35	32	0 to	38	7	31	0 to	40	3	29	6 to	43	1	27	9 to	47	5	25	6 to	55	10	23	10 to	72	0
40	36	3 to	44	9	34	10 to	47	0	32	11 to	50	10	30	10 to	57	0	28	0 to	69	8	25	2 to	97	3
50	44	3 to	57	3	42	3 to	61	6	39	6 to	78	3	36	5 to	79	9	32	7 to	106	10	28	10 to	188	10
75	62	6 to	93	9	58	6 to	104	0	53	6 to	125	0	48	1 to	170	6	41	3 to	370	6	35	7 to	Inf.	
100	78	10 to	136	6	72	10 to	159	6	65	3 to	215	0	57	3 to	395	0	48	2 to	Inf.		40	5 to	Inf.	

*Depth of Field

Calculated at 1/1000 inch Circle of Confusion.

DEPTH OF FOCUS *

4 inch LENS—16mm CAMERAS

Point of Focus	F. 2					F. 2.8					F. 4					F. 5.6					F. 8					F. 11				
	IN FOCUS FROM																													
Feet	Ft.	In.		Ft.	In.	Ft.	In.		Ft.	In.	Ft.	In.		Ft.	In.	Ft.	In.		Ft.	In.	Ft.	In.		Ft.	In.	Ft.	In.		Ft.	In.
3	2	11	to	3	1	2	11	to	3	1	2	11	to	3	1	2	10	to	3	2	2	10	to	3	2	2	10	to	3	2
4	3	11	to	4	1	3	11	to	4	1	3	10	to	4	2	3	10	to	4	2	3	10	to	4	2	3	10	to	4	2
5	4	11	to	5	1	4	11	to	5	1	4	10	to	5	2	4	10	to	5	3	4	10	to	5	3	4	9	to	5	3
6	5	11	to	6	1	5	10	to	6	2	5	10	to	6	2	5	10	to	6	3	5	10	to	6	3	5	9	to	6	8
7	6	11	to	7	2	6	10	to	7	2	6	10	to	7	2	6	10	to	7	3	6	9	to	7	3	6	7	to	7	5
8	7	11	to	8	2	7	10	to	8	2	7	10	to	8	2	7	9	to	8	5	7	7	to	8	5	7	6	to	8	7
9	8	11	to	9	2	8	10	to	9	2	8	9	to	9	3	8	8	to	9	4	8	6	to	9	6	8	5	to	9	9
10	9	11	to	10	2	9	9	to	10	2	9	9	to	10	3	9	8	to	10	5	9	5	to	10	8	9	3	to	10	11
12	11	10	to	12	3	11	8	to	12	4	11	7	to	12	5	11	5	to	12	8	11	2	to	13	0	10	11	to	13	4
14	13	9	to	14	4	13	7	to	14	5	13	5	to	14	8	13	3	to	14	10	13	0	to	15	3	12	7	to	15	10
16	15	7	to	16	4	15	6	to	16	6	15	4	to	16	10	15	0	to	17	2	14	7	to	17	8	14	1	to	18	5
18	17	6	to	18	6	17	4	to	18	8	17	1	to	19	0	16	9	to	19	6	16	3	to	20	0	15	8	to	21	2
20	19	5	to	20	7	19	2	to	20	11	18	9	to	21	4	18	5	to	21	10	17	10	to	22	9	17	2	to	23	11
25	24	1	to	25	11	23	9	to	26	2	23	3	to	27	2	22	8	to	28	0	21	9	to	29	5	20	8	to	31	6
30	28	8	to	31	5	28	2	to	32	0	27	6	to	33	0	26	9	to	34	5	25	5	to	36	6	24	0	to	40	0
35	33	2	to	36	11	32	7	to	37	10	31	9	to	39	2	30	7	to	41	2	29	0	to	44	3	27	2	to	49	3
40	37	8	to	42	6	36	10	to	43	9	35	10	to	45	6	34	2	to	48	2	32	3	to	52	7	30	0	to	59	9
50	46	6	to	54	0	45	3	to	56	0	43	7	to	59	0	41	5	to	63	5	38	5	to	71	4	35	5	to	85	3
75	67	4	to	84	5	64	9	to	89	0	61	3	to	96	11	57	3	to	109	8	51	10	to	136	3	46	3	to	197	0
100	87	0	to	117	6	82	7	to	126	6	76	8	to	143	0	70	5	to	172	0	62	7	to	249	6	54	10	to	576	0

**Depth of Field*

Calculated at 1/1000 inch Circle of Confusion.

DEPTH OF FOCUS *

6 inch LENS—16mm CAMERAS

Point of Focus	F. 2.8					F. 4					F. 5.6					F. 8					F. 11					F. 16				
	IN FOCUS FROM																													
Feet	Ft.	In		Ft.	In.	Ft.	In.		Ft.	In.	Ft.	In.		Ft.	In.	Ft.	In		Ft.	In.	Ft.	In.		Ft.	In	Ft.	In.		Ft.	In.
3	3	0	to	3	0	3	0	to	3	0	3	0	to	3	0	2	11	to	3	1	2	11	to	3	1	2	11	to	3	1
4	4	0	to	4	0	4	0	to	4	0	4	0	to	4	0	3	11	to	4	0	3	11	to	4	0	3	11	to	4	1
5	5	0	to	5	0	5	0	to	5	0	4	11	to	5	0	4	11	to	5	0	4	11	to	5	0	4	11	to	5	2
6	6	0	to	6	0	6	0	to	6	0	5	11	to	6	0	5	11	to	6	1	5	11	to	6	2	5	10	to	6	2
7	7	0	to	7	0	7	0	to	7	1	6	11	to	7	0	6	10	to	7	2	6	10	to	7	2	6	9	to	7	3
8	7	11	to	8	0	7	11	to	8	1	7	11	to	8	1	7	9	to	8	2	7	9	to	8	3	7	10	to	8	4
9	8	11	to	9	0	8	11	to	9	1	8	10	to	9	1	8	10	to	9	3	8	9	to	9	4	8	7	to	9	5
10	9	11	to	10	1	9	10	to	10	2	9	10	to	10	2	9	9	to	10	3	9	8	to	10	5	9	6	to	10	7
12	11	10	to	12	2	11	10	to	12	2	11	9	to	12	3	11	8	to	12	5	11	6	to	12	7	11	3	to	12	10
14	13	10	to	14	2	13	9	to	14	3	13	8	to	14	4	13	6	to	14	6	13	4	to	14	9	13	0	to	15	2
16	15	9	to	16	3	15	8	to	16	4	15	6	to	16	5	15	4	to	16	9	15	2	to	17	0	14	9	to	17	6
18	17	9	to	18	3	17	7	to	18	5	17	5	to	18	8	17	2	to	18	11	16	11	to	19	3	16	5	to	19	11
20	19	8	to	20	4	19	6	to	20	7	19	3	to	20	9	19	0	to	21	0	18	7	to	21	7	18	2	to	22	5
25	24	5	to	25	7	24	2	to	25	11	23	10	to	26	2	23	5	to	26	10	22	11	to	27	7	22	1	to	28	10
30	29	2	to	30	10	28	11	to	21	3	28	5	to	31	9	27	10	to	32	7	27	0	to	33	9	26	0	to	35	9
35	33	11	to	36	2	33	5	to	36	8	32	10	to	37	5	32	0	to	38	7	31	0	to	40	0	29	6	to	43	0
40	38	7	to	41	6	38	0	to	42	3	37	2	to	43	2	36	2	to	44	9	34	11	to	46	11	33	0	to	50	10
50	47	9	to	52	5	46	10	to	53	6	45	8	to	55	2	44	3	to	57	3	42	4	to	61	3	39	6	to	68	2
75	70	0	to	80	0	68	3	to	83	4	65	10	to	87	4	62	6	to	93	9	58	10	to	103	5	53	7	to	124	9
100	91	7	to	110	6	88	3	to	115	2	84	3	to	123	0	78	10	to	136	6	73	4	to	158	0	65	4	to	201	5

*Depth of Field

Calculated at 11000 inch Circle of Confusion.

FOOTAGE TIMER

Footage Obtained At Various Timing and Speeds

16 mm. CAMERAS

8 Pictures per Second		12 Pictures per Second		16 Pictures per Second		20 Pictures per Second	
Seconds	Feet	Seconds	Feet	Seconds	Feet	Seconds	Feet
1 =	1/5	1 =	3/10	1 =	2/5	1 =	1/2
2 =	2/5	2 =	3/5	2 =	4/5	2 =	1
3 =	3/5	3 =	9/10	3 =	1 1/5	3 =	1 1/2
4 =	4/5	4 =	1 1/5	4 =	1 3/5	4 =	2
5 =	1	5 =	1 1/2	5 =	2	5 =	2 1/2
6 =	1 1/5	6 =	1 4/5	6 =	2 2/5	6 =	3
7 =	1 2/5	7 =	2 1/10	7 =	2 4/5	7 =	3 1/2
8 =	1 3/5	8 =	2 2/5	8 =	3 1/5	8 =	4
9 =	1 4/5	9 =	2 7/10	9 =	3 3/5	9 =	4 1/2
10 =	2	10 =	3	10 =	4	10 =	5
15 =	3	15 =	4 1/2	15 =	6	15 =	7 1/2
20 =	4	20 =	6	20 =	8	20 =	10
25 =	5	25 =	7 1/2	25 =	10	25 =	12 1/2
30 =	6	30 =	9	30 =	12	30 =	15
35 =	7	35 =	10 1/2	35 =	14	35 =	17 1/2
40 =	8	40 =	12	40 =	16	40 =	20
45 =	9	45 =	13 1/2	45 =	18	45 =	22 1/2
50 =	10	50 =	15	50 =	20	50 =	25
55 =	11	55 =	16 1/2	55 =	22	55 =	27 1/2
1 min. =	12	1 min. =	18	1 min. =	24	1 min. =	30
2 min. =	24	2 min. =	36	2 min. =	48	2 min. =	60
3 min. =	36	3 min. =	54	3 min. =	72	3 min. =	90

1/5 Foot = 8 Frames   3/5 Foot = 24 Frames

2/5 Foot = 16 Frames   4/5 Foot = 32 Frames

FOOTAGE TIMER

Footage Obtained

At Various Timing and Speeds

16 mm. CAMERAS

24 Pictures per Second		32 Pictures per Second		48 Pictures per Second		64 Pictures per Second	
Second	Feet	Second	Feet	Second	Feet	Second	Feet
1 =	3/5	1 =	4/5	1 =	1 1/5	1 =	1 3/5
2 =	1 1/5	2 =	1 3/5	2 =	2 2/5	2 =	3 1/5
3 =	1 4/5	3 =	2 2/5	3 =	3 3/5	3 =	4 4/5
4 =	2 2/5	4 =	3 1/5	4 =	4 4/5	4 =	6 2/5
5 =	3	5 =	4	5 =	6	5 =	8
6 =	3 3/5	6 =	4 4/5	6 =	7 1/5	6 =	9 3/5
7 =	4 1/5	7 =	5 3/5	7 =	8 2/5	7 =	11 1/5
8 =	4 4/5	8 =	6 2/5	8 =	9 3/5	8 =	12 4/5
9 =	5 2/5	9 =	7 1/5	9 =	10 4/5	9 =	14 2/5
10 =	6	10 =	8	10 =	12	10 =	16
15 =	9	15 =	12	15 =	18	15 =	24
20 =	12	20 =	16	20 =	24	20 =	32
25 =	15	25 =	20	25 =	30	25 =	40
30 =	18	30 =	24	30 =	36	30 =	48
35 =	21	35 =	28	35 =	42	35 =	56
40 =	24	40 =	32	40 =	48	40 =	64
45 =	27	45 =	36	45 =	54	45 =	72
50 =	30	50 =	40	50 =	60	50 =	80
55 =	33	55 =	44	55 =	66	55 =	88
1 min. =	36	1 min. =	48	1 min. =	72	1 min. =	96
2 min. =	72	2 min. =	96	2 min. =	144	2 min. =	192
3 min. =	108	3 min. =	144	3 min. =	216	3 min. =	288

¼ Foot = 10 Frames ¾ Foot = 30 Frames

½ Foot = 20 Frames 1 Foot = 40 Frames

FOOTAGE TIMER

16 mm. Cameras and Projectors

SILENT SPEED—16 PICTURES PER SECOND

Seconds		1 Min.	2 Min.	3 Min.	4 Min.	5 Min.	6 Min.	7 Min.	8 Min.	9 Min.	10 Min.
FOOTAGE OBTAINED AT VARIOUS TIMING											
0		24	48	72	96	120	144	168	192	216	240
5	2	26	50	74	98	122	146	170	194	218	242
10	4	28	52	76	100	124	148	172	196	220	244
15	6	30	54	78	102	126	150	174	198	222	246
20	8	32	56	80	104	128	152	176	200	224	248
25	10	34	58	82	106	130	154	178	202	226	250
½ Min	12	36	60	84	108	132	156	180	204	228	252
35	14	38	62	86	110	134	158	182	206	230	254
40	16	40	64	88	112	136	160	184	208	232	256
45	18	42	66	90	114	138	162	186	210	234	258
50	20	44	68	92	116	140	164	188	212	236	260
55	22	46	70	94	118	142	166	190	214	238	262
Seconds		11 Min.	12 Min.	13 Min.	14 Min.	15 Min.	16 Min.	17 Min.	18 Min.	19 Min.	20 Min.
0		264	288	312	336	360	384	408	432	456	480
5	2	266	290	314	338	362	386	410	434	458	482
10	4	268	292	316	340	364	388	412	436	460	484
15	6	270	294	318	342	366	390	414	438	462	486
20	8	272	296	320	344	368	392	416	440	464	488
25	10	274	298	322	346	370	394	418	442	466	490
½ Min	12	276	300	324	348	372	396	420	444	468	492
35	14	278	302	326	350	374	398	422	446	470	494
40	16	280	304	328	352	376	400	424	448	472	496
45	18	282	306	330	354	378	402	426	450	474	498
50	20	284	308	332	356	380	404	428	452	476	500
55	22	286	310	334	358	382	406	430	454	478	502

These figures represent the footage of the combined time of the top minute column, plus the seconds column on left, for example:

150 feet takes 6 minutes and 15 seconds to run.

400 feet takes 16 minutes and 40 seconds to run.

FOOTAGE TIMER

16 mm. PROJECTORS

Silent Speed 24 Feet per Minute

Minutes		½ HOUR	1 HOUR	1½ HOURS	2 HOURS	2½ HOURS
FOOTAGE OBTAINED AT THE TIMING ABOVE						
0		720	1440	2160	2880	3600
1	24	744	1464	2184	2904	3624
2	48	768	1488	2208	2928	3648
3	72	792	1512	2232	2952	3672
4	96	816	1536	2256	2976	3696
5	120	840	1560	2280	3000	3720
6	144	864	1584	2304	3024	3744
7	168	888	1608	2328	3048	3768
8	192	912	1632	2352	3072	3792
9	216	936	1656	2376	3096	3816
10	240	960	1680	2400	3120	3840
11	264	984	1704	2424	3144	3864
12	288	1008	1728	2448	3168	3888
13	312	1032	1752	2472	3192	3912
14	336	1056	1776	2496	3216	3936
15	360	1080	1800	2520	3240	3960
16	384	1104	1824	2544	3264	3984
17	408	1128	1848	2568	3288	4008
18	432	1152	1872	2592	3312	4032
19	456	1176	1896	2616	3336	4056
20	480	1200	1920	2640	3360	4080
21	504	1224	1944	2664	3384	4104
22	528	1248	1968	2688	3408	4128
23	552	1272	1992	2712	3432	4152
24	576	1296	2016	2736	3456	4176
25	600	1320	2040	2760	3480	4200
26	624	1344	2064	2784	3504	4224
27	648	1368	2088	2808	3528	4248
28	672	1392	2112	2832	3552	4272
29	696	1416	2136	2856	3576	4296

These figures represent the footage of the combined time of the top hour column, plus the minute column on left. For example: 1680 feet takes 1 hour and 10 minutes to run; 3408 feet takes 2 hours and 22 minutes to run.

FOOTAGE TIMER

16 mm. Cameras and Projectors

SOUND SPEED—24 PICTURES PER SECOND

FOOTAGE OBTAINED AT VARIOUS TIMING

Seconds		1 Min.	2 Min.	3 Min.	4 Min.	5 Min.	6 Min.	7 Min.	8 Min.	9 Min.	10 Min.
0		36	72	108	144	180	216	252	288	324	360
5	3	39	75	111	147	183	219	255	291	327	363
10	6	42	78	114	150	186	222	258	294	330	366
15	9	45	81	117	153	189	225	261	297	333	369
20	12	48	84	120	155	192	228	264	300	336	372
25	15	51	87	123	159	195	231	267	303	339	375
½ Min	18	54	90	126	162	198	234	270	306	342	378
35	21	57	93	129	165	201	237	273	309	345	381
40	24	60	96	132	168	204	240	276	312	348	384
45	27	63	99	135	171	207	243	279	315	351	387
50	30	66	102	138	174	210	246	282	318	354	390
55	33	69	105	141	177	213	249	285	321	357	393

Seconds		11 Min.	12 Min.	13 Min.	14 Min.	15 Min.	16 Min.	17 Min.	18 Min.	19 Min.	20 Min.
0		396	432	468	504	540	576	612	648	684	720
5	3	399	435	471	507	543	579	615	651	687	723
10	6	402	438	474	510	546	582	618	654	690	726
15	9	405	441	477	513	549	585	621	657	693	729
20	12	408	444	480	516	552	588	624	660	696	732
25	15	411	447	483	519	555	591	627	663	699	735
½ Min	18	414	450	486	522	558	594	630	666	702	738
35	21	417	453	489	525	561	597	633	669	705	741
40	24	420	456	492	528	564	600	636	672	708	744
45	27	423	459	495	531	567	603	639	675	711	747
50	30	426	462	498	534	570	606	642	678	714	750
55	33	429	465	501	537	573	609	645	681	717	753

These figures represent the footage of the combined time of the top minute column, plus the seconds column on left, for example:

120 feet takes 3 minutes and 20 seconds to run.

642 feet takes 17 minutes and 50 seconds to run.

FOOTAGE TIMER

16 mm. PROJECTORS

Sound Speed 36 Feet per Minute

Minutes		½ HOUR	1 HOUR	1½ HOURS	2 HOURS	2½ HOURS
FOOTAGE OBTAINED AT THE TIMING ABOVE						
0		1080	2160	3240	4320	5400
1	36	1116	2196	3276	4356	5436
2	72	1152	2232	3312	4392	5472
3	108	1188	2268	3348	4428	5508
4	144	1224	2304	3384	4464	5544
5	180	1260	2340	3420	4500	5580
6	216	1296	2376	3456	4536	5616
7	252	1332	2412	3492	4572	5652
8	288	1368	2448	3528	4608	5688
9	324	1404	2484	3564	4644	5724
10	360	1440	2520	3600	4680	5760
11	396	1476	2556	3636	4716	5796
12	432	1512	2592	3672	4752	5832
13	468	1548	2628	3708	4788	5868
14	504	1584	2664	3744	4824	5904
15	540	1620	2700	3780	4860	5940
16	576	1656	2736	3816	4896	5976
17	612	1692	2772	3852	4932	6012
18	648	1728	2808	3888	4968	6048
19	684	1764	2844	3924	5004	6084
20	720	1800	2880	3960	5040	6120
21	756	1836	2916	3996	5076	6156
22	792	1872	2952	4032	5112	6192
23	828	1908	2988	4068	5148	6228
24	864	1944	3024	4104	5184	6264
25	900	1980	3060	4140	5220	6300
26	936	2016	3096	4176	5256	6336
27	972	2052	3132	4212	5292	6372
28	1008	2088	3168	4248	5328	6408
29	1044	2124	3204	4284	5364	6444

These figures represent the footage of the combined time of the top hour column, plus the minute column on left. For example: 2520 feet takes 1 hour and 10 minutes to run; 5148 feet takes 2 hours and 23 minutes to run.

PROJECTION CHART

16 mm. PROJECTOR

Size of Picture Obtained With Various Lenses

Distance From Lens To Screen	FOCAL LENGTH OF LENSES USED							
	3/4 Inch		1 Inch		1 1/2 Inch		2 Inch	
	SIZE OF PICTURE							
	Width	Height	Width	Height	Width	Height	Width	Height
Feet	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.	Ft. In.
3	1 6	1 2	1 0	9	0 9	7		
4	2 1	1 7	1 6	1 2	1 0	9	0 10	7
5	2 6	1 10	1 10	1 4	1 4	1 0	1 0	9
6	3 0	2 2	2 4	1 9	1 6	1 2	1 2	11
7	3 6	2 7	2 8	2 0	1 9	1 4	1 4	1 0
8	4 0	2 11	3 0	2 2	2 0	1 6	1 6	1 2
10	5 0	3 9	3 9	2 10	2 6	1 10	1 10	1 4
12	6 0	4 6	4 7	3 5	3 0	2 2	2 3	1 8
15	7 0	5 3	5 8	4 2	3 10	2 10	2 10	2 1
18	9 2	6 10	6 10	5 0	4 6	3 4	3 5	2 6
20	10 0	7 6	7 6	5 6	5 0	3 9	3 10	2 10
25	12 6	9 4	9 4	6 11	6 4	4 8	4 8	3 6
30	14 10	11 0	11 6	8 7	7 6	5 7	5 8	4 3
35	17 6	13 0	13 4	9 11	8 10	6 7	6 6	4 10
40	20 0	14 11	15 0	11 2	10 0	7 5	7 6	5 7
45	22 6	16 9	16 10	12 6	11 4	8 5	8 6	6 4
50	25 0	18 8	18 8	13 10	12 6	9 4	9 4	6 11
60			22 0	16 5	15 6	11 7	11 7	8 11
75					18 8	13 9	14 2	10 6
100					25 0	18 8	18 9	14 0

PROJECTION CHART

16 mm. PROJECTOR

Size of Picture Obtained With Various Lenses

Distance From Lens To Screen	FOCAL LENGTH OF LENS USED — SIZE OF PICTURE															
	2½ Inch				3 Inch				3½ Inch				4 Incn			
	Width		Height		Width		Height		Width		Height		Width		Height	
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
6	0	10		7												
7	1	0		9												
8	1	2		10												
10	1	6	1	2	1	3		11	1	0	0	9				
12	1	9	1	4	1	5	1	0	1	3	0	11	1	1	0	10
15	2	3	1	8	1	10	1	4	1	6	1	2	1	4	1	0
18	2	10	2	1	2	2	1	7	1	10	1	4	1	7	1	2
20	3	0	2	2	2	6	1	10	2	1	1	6	1	10	1	4
25	3	10	2	10	3	2	2	4	2	8	2	0	2	4	1	9
30	4	6	3	4	3	8	2	9	3	4	2	6	2	10	2	1
35	5	2	3	10	4	4	3	3	3	10	2	10	3	2	2	4
40	6	0	4	6	5	0	3	9	4	4	3	3	3	10	2	10
45	6	9	5	0	5	8	4	2	4	10	3	7	4	2	3	1
50	7	6	5	6	6	4	4	8	5	5	4	0	4	8	3	6
60	9	6	7	0	8	0	6	0	6	6	4	10	5	10	4	4
75	11	4	8	6	9	6	7	0	8	2	6	0	7	2	5	4
100	15	2	11	4	12	8	9	5	10	10	8	1	9	6	7	0
125	19	8	14	7	15	7	11	7	13	4	10	0	11	8	8	8
150	22	5	18	0	18	8	13	11	16	0	12	0	14	0	10	0

Based on Projection Aperture .284x.380

MOTION PICTURE PROJECTORS

16 mm. Silent

No.	NAME	REEL Capacity	LENS SPEED	LENS SIZE	LAMP WATTAGE	TYPE OF DRIVE	TYPE OF REWIND
1	AMPRO Model "KD".........	400 ft.	F.1.6	2" Super or 1" 1½", 2½", 3", 3½" and 4"	750 W pre-focused	Belt	Fast Automatic Rewind
2	AMPRO Model "UC".........	400 ft.	F.1.6.	2" Super or 1" 1½", 2½", 3", 3½" and 4"	750 W. pre-focused	Belt	Fast Automatic Rewind
3	AMPRO Model "YC".........	1600 ft.	F.1.6	2" Super or 1" 1½", 2½", 3", 3½" and 4"	750-1000 W. pre-focused	Belt	Fast Automatic Rewind
4	ACME Background Projector	1000 ft.	F.2	Super Cinephor 4	300W to 750W pre-focused	Inter-lock motor or Stop Motion	Automatic
5	DE VRY G5.................	400 ft.	F.1.65	3/4 in. to 6 in.	500 W	Motor & Belt	
6	FILMO DIPLOMAT..........	400 ft.	F.1.6 Filmo-coted	2 in. also 5/8 in. to 4 in.	750 W. or 1000 W.	All-Gear	Power
7	FILMO SHOWMASTER.....	2000 ft.	F.1.6 Filmo-coted	2 in. also 5/8 in. to 4 in.	750 W. or 1000 W.	All-Gear Motor to Mechanism	Power

MOTION PICTURE PROJECTORS

16 mm. Silent

No.	SPEED CONTROL	PILOT LIGHT	A.C. D.C.	REVERSE	TILT	SPECIAL FEATURES
1	Rheostat Speed Control	Yes	D.C. or 25 to 60 Cycles A.C.	Yes	Up and down tilt	Still pictures—and features as shown on Ampro Sound projectors
2	Rheostat Speed Control	Yes	D.C. or 25 to 60 Cycles A.C.	Yes	Up and down tilt	Convertable to Sound—same features as other projectors Ampro.
3	Rheostat 16 and 24 frames	Pilot & Dual	A.C.-D.A. 100 to 125 volts	Yes	Precision control	Convertable to Sound—same features as other Ampro Projectors
4	Synchronous	Operating Light		Yes Automatic Take-up	Up and down tilt	This projector has two registration pins on one side, and is steady. Used to rephotograph background projection or for rephotographing any special effects.
5	Yes		Yes	Yes	Yes	Device for tilting, single frame projection.
6	Yes	Yes	Yes	Yes	Self-Locking	Single Frame Projection—B & H Pre-aligned Lamp—"Safe Lock" Sprockets—Radio Interference Eliminator—New Super Cooling—Blowerand Vertical Fins—Floating Film Protection.
7	Yes	Yes	Yes	Yes	Self-Locking	Prefocused, Prealigned Lamp—Clutch for Still Projection—"Safe Lock" Sprockets—Radio Interference Eliminator—Floating Film Protection—Durable Lens Coating.

MOTION PICTURE PROJECTORS

16 mm. Silent

No.	NAME	REEL Capacity	LENS SPEED	LENS SIZE	LAMP WATTAGE	TYPE OF DRIVE	TYPE OF REWIND
10	KEYSTONE CC16	400 ft.	F.1.8. to F.2.8	1 in. to 4 in.	300 W	Gear	Motor
11	KEYSTONE A75	400 ft.	F.1.8 to F.2.8	1 in. to 4 in.	500 W.	Gear	Motor
12	KEYSTONE A82	400 ft.	F.1.8 to F.2.8	1 in. to 4 in.	750 W	Gear	Motor
13	KODASCOPE G	400 ft.	F.1.6	1 in. to 4 in.	750 W	Motor	Motor
14	KODASCOPE EE	400 ft.	F.2.5	1 in. to 4 in.	750 W	Motor	Motor
15	KODASCOPE G REPEATER	400 ft.	F.1.6	1 to 4 in.	400-500-750W.	Motor	Automatic Motor
16	VICTOR 16	400 ft.	F.1.6	2 in.	750 W	Motor	Motor
17	VICTOR 16-S	1600 ft.	F.1.6	2 in.	750 W	Motor	Motor
18	KEYSTONE K 160	400 ft.	F.1.6	1 in.	750 W.	Gear	Motor

MOTION PICTURE PROJECTORS

16 mm. Silent

No.	SPEED CONTROL	PILOT LIGHT	A.C. D.C.	REVERSE	TILT	SPECIAL FEATURES
10	Yes		Yes			Adjustable framer, separate light and motor switches, cast base.
11			Yes			Removable film aperture, still pictures, adjustable framer.
12	Yes	Yes	Yes	Yes		Cooling fan, adjustable framer, accurate tilt.
13	Yes	Yes	Yes	Yes		4-way lamp, separate light switch, tilting device.
14	Yes	Yes	Yes	Yes		Blower and fin cooling, rotary disc shutter.
15	Yes	Threading Light	Yes	Yes	Two Way	Automatic action—runs and rewinds automatically.
16	Yes	Yes	Yes	Yes	Yes	Patented safety film trip; 180° swing-out lens mount; Easy to-clean film channel and aperture plate; dual flexo pawls which spring over film; offset film loop prevents "screen image weave"; Spira-draft lamphouse.
17	Yes	Yes	Yes	Yes	Yes	
18		Yes		Yes	Yes	Self adjusting removable gate.

MOTION PICTURE PROJECTORS

16 mm. Sound-on-Film

No.	NAME	REEL Capacity	LENS SPEED	LENS SIZE	LAMP WATTAGE	DRIVE	TYPE OF REWIND
1	AMPRO Model YA	1600 ft.	F.1.85	2" Standard or 1", 1½", 2½", 3", 3½", and 4"	750-1000 W. pre-focused	Belt	Fast Automatic Rewind
2	AMPRO Model XA	1600 ft.	F.1.85	2" Standard or 1", 1½", 2½", 3", 3½", and 4"	750-1000W pre-focused	Belt	Fast Automatic Rewind
3	AMPRO Model YSA	1600 ft.	F.1.6	2" Super or 1" 1½", 2½", 3", 3½", 4" Super lenses	750-1000W. pre-focused	Belt	Fast Automatic Rewind
4	AMPRO PREMIER-10	2000 ft.	F.1.6 Coated	2" Super or 1", 1½", 2½", 3", 3½" and 4" Super	750 W. pre-focused	Belt	Fast Automatic Rewind
5	AMPRO Arc	2000 ft.	F.2 Coated	3" Super or 1" 1½", 2", 2½", 3½" and 4" Super Lenses	30 Amp. Hi-Intensity Arc.	Belt	Fast Automatic Rewind

MOTION PICTURE PROJECTORS

. 16 mm. Sound-on-Film

No.	SPEED CONTROL	PILOT LIGHT	A.C.-D.C.	Reverse	SPEAKER SIZE	WATTS OUTPUT	SPECIAL FEATURES
1	Silent & Sound Speed Switch Control	Pilot & Dial	A.C.-D.C. Motor, Amplifier requires converter for D.C.	No	Dual Elliptical	15 watts	Portable, Compact, Rugged, Removable front and rear cover, Automatic Fire shutter, Oilite Bearings, Illuminated Control Panel, Precision Tilting Device Framing Button, Easy Threading, Central oil distribution to High Speed Shafts, Maximum Brilliance Illumination, Heat Resisting Bi-Convex Condenser Lenses, Forced Draft Ventilation on Amplifier, Microphone or Phonograph Jack, Attached Folding Reel Arms, Micrometric Lamp Adjustment aligns Lamp Filament with optical System, Admirably Suited for Color Projection Efficient Cooling, Triple Claw Movement,
2	Sound Speed only	Both Pilot & Dial	60 Cycle A.C. only, Use 300w. converter for for D.C.	No	Single 8 inch	15 watts 8 inch	
3	Silent & Sound Speed Switch Control	Both Pilot & Dial	A.C.-D.C. Motor, Amplifier requires Converter for D.C.	Yes	Dual Elliptical	15 watts	
4	Silent & Sound Speed Switch Control	Both Pilot & Dial	Same as No. 3	Yes	12 inch P.M. Dynamic	15 watts	
5	Rheostat Speed Control	Yes	A.C.-D.C. Motor-Amplifier & Rectifier 60 cycle AC	Yes		55 watts	

MOTION PICTURE PROJECTORS

16 mm. Sound

No.	NAME	REEL Capacity	LENS SPEED	LENS SIZE	LAMP WATTAGE	TYPE OF DRIVE	TYPE OF REWIND
6	DE VRY INTERPRETER.....	1600 ft.	F.1.65	2 in.	1000 W	Motor	Motor
7	DE VRY QR12...............	1600 ft.	F.1.65	2 in.	750 W	Motor	Motor
8	DE VRY ARC...............	4000 ft.	F.1.65	2 in.	30 Amp. High Intensity Arc	Motor	Motor
9	FILMOSOUND 179...........	2000 ft.	F.1.6 Filmo-coted	2 inch. Also, 5/8 in. to 4 in.	750 W. or 1000 W.	All Gear Motor to Mechanism	Power
10	FILMOARC..................	2000 ft.	F.2 Filmo-coted	3 inch. Also, 5/8 in. to 4 in.	30 amp. High Intensity Arc	Motor and Gear	Power Separate Motor

MOTION PICTURE PROJECTORS

16 mm. Sound

No.	SPEED CONTROL	PILOT LIGHT	A.C. D.C.	REVERSE	SPEAKER SIZE	WATTS OUTPUT	SPECIAL FEATURES
6	Rheostator Governor	Yes	Motor Only	Yes	12 in.	25W	Blower cooling, one shot oiling, synchromatic threading, dual sound stabilizers.
7					12 in.	12W	Fan cooling, tilting device, built-in apmlifier.
8	16-24	Yes	A.C.		Cellular Horn	30W	Heavy duty sprocket intermittent, separate ventilating system.
9	16-24	Yes	AC-DC Motor AC Amplifier	Yes	12 in.	14W	Clutch for still pictures—Magnalite Condenser—Radio Interference Eliminator—"Safe Lock" Sprockets—Sound or Silent Projection—Duraable Lens Coating—Floating Film Protection—Undistorted sound at all volume levels.
10	16-24	No	A.C.	No	2-12 in.	50W	Arc operates on 28 volt converted by rectifier—Two Speakers—Radio Interference Eliminator—Constant tension take-up—"Safe Lock" Sprockets—Durable Lens Coating—Floating Film Protection—Undistorted sound at all volume levels.

MOTION PICTURE PROJECTORS

16 mm. Sound

No.	NAME	REEL Capacity	LENS		LAMP WATTAGE	TYPE OF DRIVE	TYPE OF REWIND
			SPEED	SIZE			
14	KODASCOPE FS-10-N	2000 ft.	F.1.6	1 in. to 4 in.	750 W	Motor	Separate Motor
15	KODASCOPE FB25...........	1600 ft.	F.1.6	1 in. to 4 in.	750 W	Motor	Separate Motor
16	KODASCOPE F..............	1600 ft.	F.1.6	1 in. to 4 in.	750 W	Motor	
17	KODASCOPE SOUND SPECIAL..................	1600 ft.	F.1.6	2 in. to 4 in.	750 W	Motor	Separate Motor
19	MOVIE-Mite	1600 ft.			200 W	Motor	Motor
20	R.C.A. PG170........	1600 ft.	F.1.65	1 in. to 4 in.	750 to 1000 W	Motor	Separate Motor
21	VICTOR 40A	1600 ft.	F.1.6	2″ interchangeable	750 W.	Motor	Motor
22	VICTOR 40B	1600 ft.	F.1.6	2″ Interchangeable	750 W	Motor	Motor
23	VICTOR "E" ARC	1600 ft.	F.1.6	2″ Interchangeable	30 amp. Arc.	Motor	Extra
24	VICTOR "60"................	200 ft.	F.1.6	2 in.	1000 W.	Motor	Motor

MOTION PICTURE PROJECTORS

16 mm. Sound

No.	SPEED CONTROL	PILOT LIGHT	A.C. D.C.	REVERSE	SPEAKER SIZE	WATTS OUTPUT	SPECIAL FEATURES
14	16-24	Thread Light	A.C. 50-60 Cycle		10 in.	10 to 40W	10 watt amplifier, oil floated fly wheel, blower cooling, control panel for all controls.
15	16-24				2-12 in.	25W	Jack for mike on phonograph pick-up.
16					10 in.	10W	Built-in motor generator for amplifier.
17	Automatic				10 in.	14W	Rotary disc shutter, blower cooling, film snubbers, tilting device.
19	16-24	No	A.C. D.C.	No	6 in.	2½W	Extreme simplicity, low price. Small case houses entire outfit.
20	16-24	Yes	D.C. with		10 in.	14W	Blower cooling, sealed lubrication.
21	Yes, 16 & 24	Yes	Motor & Lamp	Yes	8 inch or 12 inch	15 watts	Patented safety film trip; Swing-out lens mount; Easy to clean film channel and aperture plate; Dual Flexo Pawls which spring over film; Offset film loop prevents "screen image weave"; Spira-Draft lamphouse; Two stabilizing Filters; No Refocusing for sound-on-film color film
22	Yes, 16 & 24	Yes	Motor & Lamp	Yes	12 inch or 15 inch	23 watts	
23	Yes, 16 & 24	Yes	A.C.		12 inch or 15 inch	Optional amplification	
24	Yes, 16 & 24	Yes	A.C. D.C.	Yes	12 in.		Instantilt—Dual tone Control, Leveling Device.

MOTION PICTURE CAMERAS

8 mm.

No.	NAME	SHUTTER OPENING	SPEEDS	EXPOSURE at 16 Frames	FILM CAPACITY	LENS AND MOUNTS
1	BOLEX H8	190°	8, 16, 24, 32, 64	1/30 sec.	25 to 100 ft. Double Eight	F.1.5 Hugo Meyer
2	CINE KODAK 8-20	180°	16	1/32 sec.	50 ft. Double Eight	F.3.5 13 mm. Fixed Focus
3	CINE KODAK 8-25	180°	16	1/32 sec.	50 ft. Double Eight	F.2.7 13 mm. Fixed Focus
4	CINE KODAK 8-60	180°	16	1/32 sec.	50 ft. Double Width	F.1.9 13 mm. Focusing Mount
5	MAGAZINE CINE KODAK 90	165°	8, 16, 24, 32, 64	1/35 sec.	25 ft. Double Width	F.1.9 13 mm. Focusing Mount
6	CINE ERFEX	170°	8, 16, 24, 32, 64	1/30 sec.	50 ft. Double Eight	F.2.5 1/2 in. Wollensak 3 Lens Turret Head
7	EUMIG C3		8, 16, 32			F,2.7 12 1/2 mm. Lens

MOTION PICTURE CAMERAS

8 mm.

No.	TYPE OF DRIVE	Footage per Winding	TYPE OF FOCUS	TYPE OF FINDER	SPECIAL FEATURES
1	Spring Motor		Ground Glass Focusing	Spy Glass Type Parallax Adjustment	Automatic threading, single exposure device, 3 lens turret.
2	Spring Motor	5 1/2 ft.	Fixed Focus	Eye Level Parallex Corrected	Footage meter, lens not interchangeable.
3	Spring Motor	5 1/2 ft.	Fixed Focus	Eye Level Parallex Corrected	Lens not interchangeable.
4	Spring Motor	5 1/2 ft.	Scale	Direct Eye Level Parallex Corrected	Built-in exposure guide and lens shade.
5	Spring Motor	5 1/2 ft.	Scale	Enclosed View Finder	Interchangeable lenses.
6	Spring	6 ft.	Scale	Eye Level Optical View Finder	Built-in exposure guide, positive start.
7	Spring		Scale	Built-In Optical View Finder	Geared footage indicator, single frame release.

MOTION PICTURE CAMERAS

8 mm.

No.	NAME	SHUTTER OPENING	SPEEDS	EXPOSURE at 16 Frames	FILM CAPACITY	LENS & MOUNTS	FOOTAGE PER WINDING
8	FILMO SPORTSTER 8	165°	16-32 48-64	1/35 sec.	25 ft. Double Run	F.2.5 12½ mm. Bayonet Mount Filmocoted	5 ft.
9	FILMO TRI-LENS 8	165°	16-32 48-64	1/35 sec.	25 ft. Double Run	F.2.5 12½ mm. Filmocoted Screw Mount 3 Lens Rotating Turret	5 ft.
10	DE JUR		16-16 24-64		Magazine Load	3 Lens Turret	8 ft.
11	BRISKIN 8		16-24 32-62		Magazine Load	F 1.9 or F.2.5 Coated	
12	PERFEX A8		5 Speeds		Magazine Load	F.1.9 or F.2.5 Coated	
13	KEYSTONE K8	140°	12-16-48	1/40 sec.	25 ft. Double 30 ft. Single.	F.1.9 Wollensak	5 ft.
14	REVERE	160°	8-12-16 24-32	1/36 sec.	50 ft. Double	F.1.9 12½ mm. Focusing Moun	5 ft.
15	Universal CINEMASTER		16-24-32	1/30 sec.	30 ft. Single 50 ft. Double	F.1.9-2.5-3.5 Interchangeable	6ft.

MOTION PICTURE CAMERAS

8 mm.

No.	TYPE OF DRIVE	TYPE OF FOCUS	TYPE OF FINDER	SPECIAL FEATURES
8	Spring Motor Gear Drive	Universal Focus	Spy Glass Type	Interchangeable Lenses—Built-in Exposure Calculator—Single Frame Device—Simplified Loading —Durable Lens Coating
9	Spring Motor Gear Drive	Universal Focus	Positive. Moves with turret. Automatically changed to match lens.	Interchangeable Lenses—Built-in Exposure Calculator—Single Frame Device—3 Lens Turret Mtg. Lenses and Matching Viewfinder Objectives.
10	Spring Motor	Scale		All Die-cast Aluminum—Built-in Compensating
11	Spring Motor	Scale	Clear Image	Parallax Indicator—Single Frame Exposures
12	Spring Motor	Scale	Built-in Compensating	3 Lens Turret—Built-in Compensating Finders
13	Spring Motor	Fixed Focus and Focusing Mount	Direct and Built-in Eye Level	Interchangeable Lenses—Takes double and single width film. Built-in Exposure Chart—Focusing Mounts.
14	Spring Motor	Scale	Parallax Corrected Optic View Finder	Interchangeable 3 Lens Turret
15	Spring Motor	Scale	Built-in Optical	Exposure Calculator—Automatic Footage Counter

ANSCO MOTION PICTURE FILMS

8mm Cameras

NAME	TYPE	USE	CHARACTERISTICS	ROLLS AVAILABLE	SPEED			
					WESTON		G. E.	
					Day.	Tung.	Day.	Tung.
TWIN-EIGHT TRIPLE S PAN REVERSIBLE	Rev .	Interiors, Sports, Difficult light conditions	Extreme high speed, balanced color sensitivity, fine grain, wide latitude, medium contrast	25 Ft.	100	64	150	100
TWIN-EIGHT HYPAN REVERSIBLE	Rev.	General outdoor work, sports and portraits, flat light conditions	High speed, full color balance, brilliance and fine grain, excellent for filter use	25 Ft.	24	16	40	24

Purchase price includes processing by Ansco Co.

EASTMAN MOTION PICTURE FILMS

8mm SAFETY

NAME	TYPE	USE	CHARACTERISTICS	ROLLS AVAILABLE	SPEED: WESTON		SPEED: G. E.	
					Sun	Tung.	Sun	Tung.
CINE KODAK* EIGHT PAN	Double 8	Exteriors and general photography.	Reversal film.	25 ft. rolls.	8	6	12	10
CINE KODAK * SUPER X PAN	Double 8	Interiors and general photography.	Reversal film.	25 ft. rolls. 25 ft. magazines.	32	24	48	40
KODACHROME * SAFETY	Double 8 Daylight	Color photography, for exteriors.	Color balanced for sunlight.	25 ft. rolls. 25 ft. magazines.	8	*3	12	*5
KODACHROME * SAFETY TYPE A	Double 8 A	For interiors with photo flood lamps.	Color balanced for photoflood lamps.	25 ft. rolls. 25 ft. magazines.	**8	12	** 12	20
KODAK POSITIVE	Double 8	For printing and title use only.	Not processed by Eastman Kodak Co.	100 ft. rolls. Darkroom loading		*** 2.5		*** 4
KODAK LEADER	Single 8			50 ft. rolls.				

All (Double Eight) Kodak films are supplied in 16mm width, with special perforations for use in 8mm cameras of the double row type. A row of pictures is made down one side of the film, then the film is run through a second time and another row of pictures is made on the other side of the film. After processing, the film is cut down the center, the ends joined and the roll returned for projection in any 8mm projector.

*When Kodachrome filter for photoflood (Wratten No. 80) is used.
**When Type A Kodachrome filter for daylight (Wratten No. 85) is used.
***Values when light is measured from a white card for making titles.

†Purchase price includes free processing by Eastman Kodak Co.

LENS ANGLES

FIELD OF VIEW OBTAINED AT VARIOUS DISTANCES FROM CAMERA

8 mm. CAMERAS

SIZE OF LENS

Distance From Lens To Subject In Feet	12½ mm.				25 mm.				38 mm.			
	Height		Width		Height		Width		Height		Width	
	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
2		5		6								
3		6		8								
4	1	0	1	3						3		4
5	1	3	1	8						4		5
6	1	5	2	0		8	1	0		5		6
7	1	8	2	4		9	1	2		6		8
8	2	0	2	7	1	0	1	4		6		9
9	2	3	2	11	1	2	1	6		7		11
10	2	5	3	3	1	3	1	8		8	1	1
12	3	2	4	2	1	5	2	0	1	0	1	4
14	3	6	4	8	1	8	2	5	1	3	1	7
16	4	1	5	5	2	1	2	8	1	5	1	9
18	4	7	6	2	2	4	3	2	1	6	2	1
20	5	1	6	8	2	6	3	6	1	7	2	3
25	6	3	8	4	3	2	4	3	2	2	2	9
30	7	7	10	2	3	8	5	2	2	6	3	5
40	10	2	13	6	5	2	6	10	3	4	4	7
50	12	10	17	1	6	6	8	6	4	4	5	8
75	19	4	25	8	9	8	13	0	6	4	8	5
100	25	10	34	4	13	3	17	5	8	6	11	6

FRAME TOTALIZER

Showing Amount of Frames in
Various Footage Totals

8 MM. FILM

1/10 Ft. = 8 Frames	3/5 Ft. = 48 Frames
1/5 Ft. = 16 Frames	7/10 Ft. = 56 Frames
3/10 Ft. = 24 Frames	4/5 Ft. = 64 Frames
2/5 Ft. = 32 Frames	9/10 Ft. = 72 Frames
1/2 Ft. = 40 Frames	1 Ft. = 80 Frames

Ft. Frames	Ft. Frames	Ft. Frames	Ft. Frames	Ft. Frames
1= 80	21=1680	41=3280	61=4880	81=6480
2= 160	22=1760	42=3360	62=4960	82=6560
3= 240	23=1840	43=3440	63=5040	83=6640
4= 320	24=1920	44=3520	64=5120	84=6720
5= 400	25=2000	45=3600	65=5200	85=6800
6= 480	26=2080	46=3680	66=5280	86=6880
7= 560	27=2160	47=3760	67=5360	87=6960
8= 640	28=2240	48=3840	68=5440	88=7040
9= 720	29=2320	49=3920	69=5520	89=7120
10= 800	30=2400	50=4000	70=5600	90=7200
11= 880	31=2480	51=4080	71=5680	91=7280
12= 960	32=2560	52=4160	72=5760	92=7360
13=1040	33=2640	53=4240	73=5840	93=7440
14=1120	34=2720	54=4320	74=5920	94=7520
15=1200	35=2800	55=4400	75=6000	95=7600
16=1280	36=2880	56=4480	76=6080	96=7680
17=1360	37=2960	57=4560	77=6160	97=7760
18=1440	38=3040	58=4640	78=6240	98=7840
19=1520	39=3120	59=4720	79=6320	99=7920
20=1600	40=3200	60=4800	80=6400	100=8000

DEPTH OF FOCUS *

12½mm LENS—8mm CAMERAS

Point of Focus	F.1.5			F.1.8			F.2.5			F.3.5			F.4.5		
	IN FOCUS FROM														
Feet	Ft. In.		Ft. In.	Ft. In.		Ft. In.	Ft. In.		Ft. In.	Ft. In.		Ft. In.	Ft. In.		Ft.
2	1 9	to	2 5	1 9	to	2 6	1 7	to	2 8	1 6	to	3 4	1 4	to	4 0
3	2 6	to	3 11	2 5	to	4 2	2 2	to	4 9	1 11	to	7 6	1 8	to	12 0
4	3 0	to	4 8	2 11	to	6 4	2 8	to	8 0	2 4	to	20 0	2 0	to	Inf.
5	3 7	to	8 2	3 4	to	9 2	3 1	to	13 4	2 6	to	Inf.	2 4	to	Inf.
6	4 0	to	11 3	3 11	to	13 2	3 6	to	24 0	2 8	to	Inf.	2 5	to	Inf.
7	4 7	to	15 2	4 4	to	19 3	3 9	to	56 0	2 11	to	Inf.	2 6	to	Inf.
8	5 0	to	20 10	4 7	to	29 4	4 0	to	Inf.	3 1	to	Inf.	2 8	to	Inf.
9	5 4	to	29 9	4 11	to	49 6	4 3	to	Inf.	3 3	to	Inf.	2 9	to	Inf.
10	5 7	to	43 4	5 3	to	110 0	4 5	to	Inf.	3 4	to	Inf.	2 10	to	Inf.
11	5 11	to	71 6	5 6	to	Inf.	4 8	to	Inf.	3 5	to	Inf.	2 11	to	Inf.
12	6 3	to	156 0	5 10	to	Inf.	4 10	to	Inf.	3 6	to	Inf.	3 0	to	Inf.
13	6 6	to	Inf.	6 0	to	Inf.	4 11	to	Inf.	3 7	to	Inf.	3 1	to	Inf.
14	6 10	to	Inf.	6 2	to	Inf.	5 1	to	Inf.	3 8	to	Inf.	3 2	to	Inf.
15	6 11	to	Inf.	6 4	to	Inf.	5 2	to	Inf.	3 9	to	Inf.	3 3	to	Inf.
18	7 6	to	Inf.	6 11	to	Inf.	5 6	to	Inf.	3 11	to	Inf.	3 4	to	Inf.
20	7 10	to	Inf.	7 1	to	Inf.	5 9	to	Inf.	4 0	to	Inf.	3 5	to	Inf.
25	8 9	to	Inf.	7 8	to	Inf.	6 0	to	Inf.	4 2	to	Inf.	3 6	to	Inf.

**Depth of Field*

Calculated at 1/1000 inch Circle of Confusion.

DEPTH OF FOCUS*

1 inch LENS—8mm CAMERAS

Point of Focus	F.1.8				F.2.5				F.3				F.3.5				F.4.5				F.6.3			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	2	10 to	3	2	2	9 to	3	3	2	9 to	3	5	2	8 to	3	5	2	7 to	3	7	2	7 to	3	10
4	3	8 to	4	5	3	7 to	4	6	3	6 to	4	8	3	5 to	4	9	3	3 to	5	1	3	0 to	5	8
5	4	6 to	5	7	4	4 to	5	11	4	3 to	6	2	4	2 to	6	4	3	11 to	6	10	3	8 to	7	11
6	5	4 to	6	11	5	1 to	7	4	4	11 to	7	8	4	9 to	8	0	4	6 to	8	11	4	2 to	10	10
7	6	1 to	8	3	5	9 to	8	10	5	7 to	9	4	5	5 to	9	11	5	0 to	11	3	4	7 to	14	6
8	6	10 to	9	8	6	5 to	10	6	6	2 to	11	2	6	0 to	12	0	5	7 to	14	2	5	0 to	19	8
9	7	6 to	11	2	7	0 to	12	3	6	9 to	13	3	6	6 to	14	5	6	1 to	17	6	5	5 to	27	0
10	8	2 to	12	9	7	9 to	14	3	7	4 to	15	8	7	0 to	17	3	6	6 to	21	10	5	9 to	38	7
11	8	11 to	14	5	8	3 to	16	5	7	11 to	18	2	7	6 to	20	5	6	11 to	27	1	6	1 to	59	6
12	9	6 to	16	3	8	10 to	18	9	8	5 to	21	1	8	0 to	24	2	7	9 to	34	2	6	4 to	108	0
13	10	2 to	18	1	9	4 to	21	2	8	10 to	24	5	8	5 to	28	8	7	8 to	43	9	6	8 to	350	0
14	10	9 to	20	1	9	10 to	24	0	9	4 to	28	2	8	10 to	34	1	7	11 to	57	9	6	11 to	Inf.	
15	11	4 to	22	3	10	4 to	27	2	9	9 to	32	7	9	2 to	40	8	8	3 to	79	5	9	1 to	Inf.	
18	13	0 to	29	7	11	8 to	38	11	10	11 to	51	0	10	3 to	74	3	9	2 to	Inf.		7	9 to	Inf.	
20	14	0 to	35	4	12	7 to	49	11	11	8 to	71	5	10	10 to	126	6	9	8 to	Inf.		8	1 to	Inf.	
25	16	2 to	54	4	14	4 to	97	6	13	2 to	250	6	12	2 to	Inf.		10	8 to	Inf.		8	9 to	Inf.	
30	18	2 to	85	3	15	10 to	287	6	14	5 to	Inf.		13	3 to	Inf.		10	6 to	Inf.		9	5 to	Inf.	
40	21	6 to	295	6	18	3 to	Inf.		16	5 to	Inf.		14	11 to	Inf.		12	8 to	Inf.		10	2 to	Inf.	
50	24	3 to	Inf.		20	4 to	Inf.		17	10 to	Inf.		16	0 to	Inf.		13	6 to	Inf.		10	8 to	Inf.	

*Depth of Field

Calculated at 1/1000 inch Circle of Confusion.

DEPTH OF FOCUS *

38mm LENS—8mm CAMERAS

Point of Focus	F.1.5				F.2				F.2.8				F.4				F.5.6				F.8			
	IN FOCUS FROM																							
Feet	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.
3	2	11 to	3	0	2	11 to	3	0	2	11 to	3	2	2	10 to	3	2	2	9 to	3	4	2	8 to	3	5
4	3	10 to	4	2	3	10 to	4	2	2	11 to	4	3	3	8 to	4	5	3	7 to	4	6	3	5 to	4	10
5	4	10 to	5	2	9	10 to	5	3	4	8 to	5	5	4	6 to	5	7	4	4 to	5	11	4	2 to	6	4
6	5	9 to	6	4	5	8 to	6	5	5	6 to	6	7	5	4 to	6	11	5	1 to	7	4	4	9 to	8	0
7	6	8 to	7	5	6	6 to	7	7	6	4 to	7	10	6	1 to	8	3	5	10 to	8	10	5	5 to	9	11
8	7	6 to	8	7	7	4 to	8	9	7	2 to	9	1	6	10 to	9	8	6	6 to	10	6	6	0 to	12	2
9	8	5 to	9	8	8	2 to	9	11	7	11 to	10	5	7	6 to	11	2	7	1 to	12	4	6	6 to	14	7
10	9	3 to	10	10	9	0 to	11	2	8	8 to	11	9	8	3 to	12	9	7	8 to	14	3	7	0 to	14	5
12	10	11 to	13	4	10	8 to	13	10	10	2 to	14	7	9	7 to	16	3	8	10 to	18	9	8	0 to	24	7
14	12	7 to	15	10	12	2 to	16	6	11	7 to	17	9	10	9 to	20	0	9	11 to	24	0	8	9 to	34	8
16	14	2 to	18	4	13	8 to	19	4	12	11 to	21	0	11	11 to	24	3	10	11 to	30	7	9	6 to	50	2
18	15	9 to	21	1	15	0 to	22	4	14	2 to	24	7	13	0 to	29	4	11	9 to	38	11	10	3 to	77	0
20	17	3 to	23	10	16	6 to	25	7	15	5 to	28	5	14	0 to	35	0	12	7 to	49	9	10	10 to	134	0
25	20	10 to	31	3	19	8 to	34	2	18	3 to	39	11	16	3 to	53	9	14	4 to	98	9	12	1 to	Inf.	
30	24	2 to	39	6	22	8 to	44	3	27	7 to	54	3	18	3 to	83	7	15	10 to	287	6	13	2 to	Inf.	
35	27	5 to	48	9	25	5 to	56	3	23	0 to	73	3	20	0 to	139	6	17	2 to	Inf.		14	1 to	Inf.	
40	30	4 to	58	9	27	11 to	70	1	25	0 to	90	11	21	7 to	257	6	18	3 to	Inf.		14	10 to	Inf.	
50	33	9 to	83	6	32	6 to	108	0	28	7 to	196	6	24	2 to	Inf.		20	1 to	Inf.		16	0 to	Inf	
75	46	10 to	188	0	41	6 to	183	6	35	5 to	Inf.		28	9 to	Inf.		23	1 to	Inf.		17	11 to	Inf	

**Depth of Field*

Calculated at 1/1000 inch Circle of Confusion.

FOOTAGE TIMER

Footage Obtained at Various Timing and Camera Speeds

8 mm. FILM

Seconds	8 Pictures Per Second Feet	16 Pictures Per Second Feet	24 Pictures Per Second Feet	32 Pictures Per Second Feet	48 Pictures Per Second Feet	64 Pictures Per Second Feet
1	1/10	1/5	3/10	2/5	3/5	4/5
2	1/5	2/5	3/5	4/5	1 1/5	1 3/5
3	3/10	3/5	9/10	1 1/5	1 4/5	2 2/5
4	2/5	4/5	1 1/5	1 3/5	2 2/5	3 1/5
5	1/2	1	1 1/2	2	3	4
6	3/5	1 1/5	1 4/5	2 2/5	3 3/5	4 4/5
7	7/10	1 2/5	2 1/10	2 4/5	4 1/5	5 3/5
8	4/5	1 3/5	2 2/5	3 1/5	4 4/5	6 2/5
9	9/10	1 4/5	2 7/10	3 3/5	5 2/5	7 1/5
10	1	2	3	4	6	8
12	1 1/5	2 2/5	3 3/5	4 4/5	7 1/5	9 3/5
14	1 2/5	2 4/5	4 1/5	5 3/5	8 2/5	11 1/5
16	1 3/5	3 1/5	4 4/5	6 2/5	9 3/5	12 4/5
18	1 4/5	3 3/5	5 2/5	7 1/5	10 4/5	14 2/5
20	2	4	6	8	12	16
25	2 1/2	5	7 1/2	10	15	20
30	3	6	9	12	18	24
35	3 1/2	7	10 1/2	14	21	28
40	4	8	12	16	24	32
45	4 1/2	9	13 1/2	18	27	36
50	5	10	15	20	30	40
55	5 1/2	11	16 1/2	22	33	44
1 Min.	6	12	18	24	36	48

1/10 Foot = 8 Frames	3/5 Foot = 48 Frames
1/5 Foot = 16 Frames	7/10 Foot = 56 Frames
3/10 Foot = 24 Frames	4/5 Foot = 64 Frames
2/5 Foot = 32 Frames	9/10 Foot = 72 Frames
1/2 Foot = 40 Frames	1 Foot = 80 Frames

FOOTAGE TIMER

8 mm. Cameras and Projectors

16 PICTURES PER SECOND

FOOTAGE OBTAINED AT VARIOUS TIMING

Seconds		1 Min.	2 Min.	3 Min.	4 Min.	5 Min.	6 Min.	7 Min.	8 Min.	9 Min.	10 Min.
0		12	24	36	48	60	72	84	96	108	120
5	1	13	25	37	49	61	73	85	97	109	121
10	2	14	26	38	50	62	74	86	98	110	122
15	3	15	27	39	51	63	75	87	99	111	123
20	4	16	28	40	52	64	76	88	100	112	124
25	5	17	29	41	53	65	77	89	101	113	125
½ Min	6	18	30	42	54	66	78	90	102	114	126
35	7	19	31	43	55	67	79	91	103	115	127
40	8	20	32	44	56	68	80	92	104	116	128
45	9	21	33	45	57	69	81	93	105	117	129
50	10	22	34	46	58	70	82	94	106	118	130
55	11	23	35	47	59	71	83	95	107	119	131

Seconds		11 Min.	12 Min.	13 Min.	14 Min.	15 Min.	16 Min.	17 Min.	18 Min.	19 Min.	20 Min.
0		132	144	156	168	180	192	204	216	228	240
5	1	133	145	157	169	181	193	205	217	229	241
10	2	134	146	158	170	182	194	206	218	230	242
15	3	135	147	159	171	183	195	207	219	231	243
20	4	136	148	160	172	184	196	208	220	232	244
25	5	137	149	161	173	185	197	209	221	233	245
½ Min	6	138	150	162	174	186	198	210	222	234	246
35	7	139	151	163	175	187	199	211	223	235	247
40	8	140	152	164	176	188	200	212	224	236	248
45	9	141	153	165	177	189	201	213	225	237	249
50	10	142	154	166	178	190	202	214	226	238	250
55	11	143	155	167	179	191	203	215	227	239	251

These figures represent the footage of the combined time of the top minute column, plus the seconds column on left, for example:

40 feet takes 3 minutes and 20 seconds to run

134 feet takes 11 minutes and 10 seconds to run

PROJECTION CHART

8 mm. FILM

SIZE OF PICTURE OBTAINED WITH VARIOUS LENSES

Focal Length of Lens Used

Distance from Lens to Screen	½ INCH		¾ INCH		1 INCH		1½ INCH	
	SIZE OF PICTURE							
Feet	Width Ft. In.	Height Ft. In.	Width Ft. In.	Height Ft. In.	Width Ft. In.	Height Ft. In.	Width Ft. In.	Height Ft. In.
3	1 0	9	9	7				
4	1 6	1 2	1 0	9	10	8		
5	2 0	1 6	1 4	1 0	1 0	9		
6	2 4	1 9	1 6	1 2	1 2	11		
8	3 0	2 3	2 0	1 6	1 6	1 2		
10	3 9	2 9	2 6	1 11	1 10	1 5	1 3	11
12	4 7	3 5	3 0	2 3	2 3	1 8	1 5	1 0
15	5 8	4 3	3 10	2 10	2 10	2 2	1 10	1 5
18	6 10	5 2	3 6	3 5	3 5	2 6	2 2	1 8
20	7 6	5 8	5 0	3 9	3 9	2 10	2 6	1 11
25	9 4	7 0	6 4	4 9	4 8	3 6	3 2	2 5
30	11 6	8 8	7 6	5 8	5 8	4 3	3 8	2 9
35	13 4	10 0	8 10	6 8	6 6	4 11	4 4	3 3
40	15 0	11 3	10 0	7 6	7 6	5 8	5 0	3 9
45	16 10	12 8	11 4	8 6	8 6	6 5	5 8	4 3
50	18 8	14 0	12 6	9 5	9 4	7 0	6 4	4 9
75			18 8	14 0	14 6	10 11	9 6	7 1
100					18 10	14 2	12 8	9 6

MOTION PICTURE PROJECTORS

8 mm.

No.	NAME	REEL Capacity	LENS		LAMP WATTAGE	TYPE OF DRIVE	TYPE OF REWIND
			SPEED	SIZE			
1	KEYSTONE A8	400 ft.	F.1.6 to F.2	3/4 in. to 1 1/2 in.	750 W	Gear	Motor
2	KEYSTONE CC8	400 ft.	F.1.85 to F.2.5	3/4 in. to 1 1/2 in.	200 W or 300W	Gear	Motor
3	KEYSTONE R8	400 ft.	F.1.85 to F.2.5	3/4 in. to 1 1/2 in.	500 or less	Gear	Motor
4	REVERE 80	300 ft.	F.1.6	1 in.	500 W	Gear	Motor
5	REVERE 85	300 ft.	F.1.6	1 in.	500 W		Motor
6	KODASCOPE 20	200 ft.	F.2.5			Belt	
7	KODASCOPE 70	200 ft.	F.1.6		500 W	Belt	
8	KODASCOPE 50	200 ft.			300 W	Belt	
9	KODASCOPE 8-33	200 ft.	F.2	1 in.	500 W	Belt	Motor
10	AMPRO A8	400 ft.	F.1.6 Coated	1 in. standard or ¾ & 1½ in.	500 W	Belt	Fast Automatic
11	DE JUR	400 ft.			750 W	Gear&Chain	Rapid

MOTION PICTURE PROJECTORS
8 mm.

No.	SPEED CONTROL	PILOT LIGHT	A.C. D.C.	REVERSE	TILT	SPECIAL FEATURES
1	Yes	Yes	Yes	Yes		Adjustable framing device, cooling fan.
2	Yes		Yes			Adjustable framer, fast tilter, cooling fan.
3	Yes	Yes	Yes			Strong ventilating system.
4	Yes		Yes			Double blower cooling system.
5	Yes	Yes	Yes			Lever control clutch.
6	Yes		A.C.			Built-in transformer, framing and tilting device.
7	Yes		Yes			Still pictures, automatic reel lock and fire shutter
8	Rheostat	Automatic	Yes	Yes	Precision Control	Still pictures, tilt control, removable optics, easy threading.
9	Yes	No	Yes	No	Two Way	Still picture projection, prefocused, pre-aligned lamp direct beam optical system. Blower and fin cooling.
10	Yes	No	Yes	Yes	Two Way	
11	Yes	Yes	Yes	Yes		Still projection—double claw movement

MOTION PICTURE PROJECTORS

8 mm.

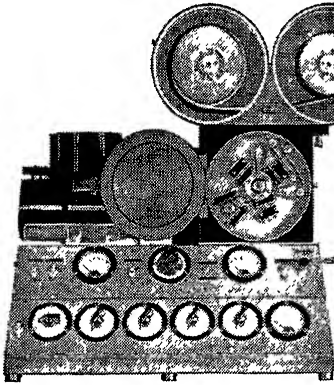
No.	NAME	REEL Capacity	LENS		LAMP WATTAGE	TYPE OF DRIVE	TYPE OF REWIND
			SPEED	SIZE			
11	FILMO-MASTER 400	400 ft.	F.1.6 Filmocoted	1 in. and Interchangeable	400W or 500W	All-Gear	Power
12	PICTURE MASTER	400 ft.	F.1.6 Filmocoted	1 in. and Interchangeable	500W or 750W	All-Gear TakeUp	Power
13	BOLEX 8	400 ft.	F.1.5		500 W	Gear	Power
14	EXCEL 110	200 ft.	F.1.8		500 W	Belt	Motor
15	IRWIN ZEPHYR 8	200 ft.	F.2		250 W	Belt	
16	UNIVEX 500	200 ft.	F.1.6		500 W	Belt	Motor
17	UNIVEX P8	200 ft.	F.1.6		500 W	Belt	Motor

MOTION PICTURE PROJECTORS (Continued)

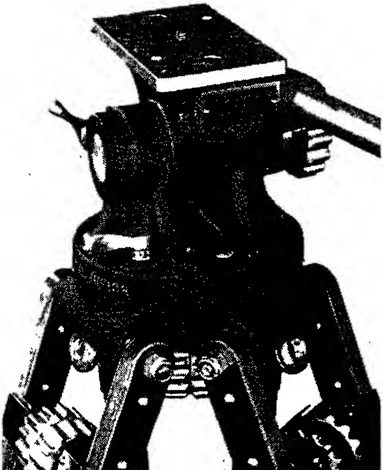
8 mm.

No.	SPEED CONTROL	PILOT LIGHT	A.C. D.C.	REVERSE	TILT	SPECIAL FEATURES
11	Yes	No	Yes	No	Self Locking	Floating film protection—Clutch for still projection—Pre-aligned lamp—Radio interference elminator.
12	Yes	Yes	Yes	Yes	Self Locking	"Safe Lock" sprockets—Controls centrally located—Clutch for still protection—Pre-aligned lamp—Radio Interference Eliminator. Base-up projection lamp-Fixed axis framing-"Wind tunnel" cooling.
13	Yes	Yes	Yes	Yes		Prefocused lamp, fan type shutter, forced draft cooling.
14	Yes		Yes		Screw	Framing and Tilting device.
15	Yes		Yes		Screw	Automatic Safety Shutter—Positive framing device.
16		Yes	Yes			Single frame projection, motor and fin ventilation.
17			A.C.			Tilting device, black enamel finish.

First Printing Sixth Edition, October, 1947



"PROFESSIONAL JUNIOR"



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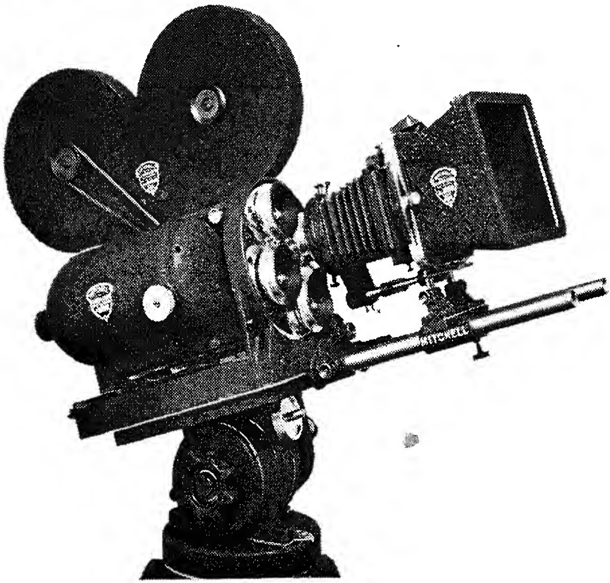
Mitchell * 16mm



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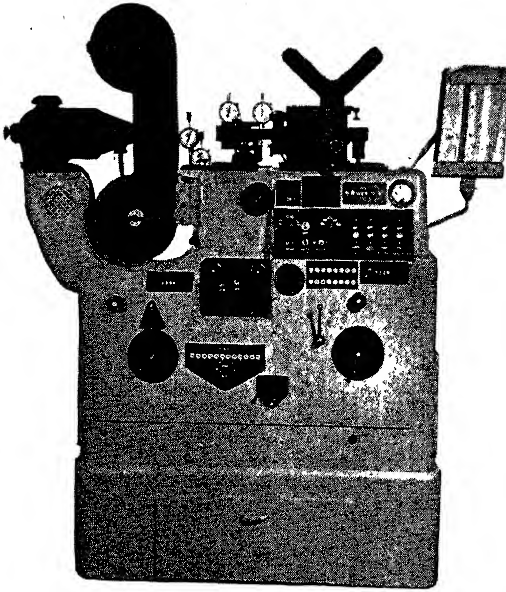
* 85% of the motion pictures shown in theatres throughout the world are filmed with a Mitchell



(See Page 179)